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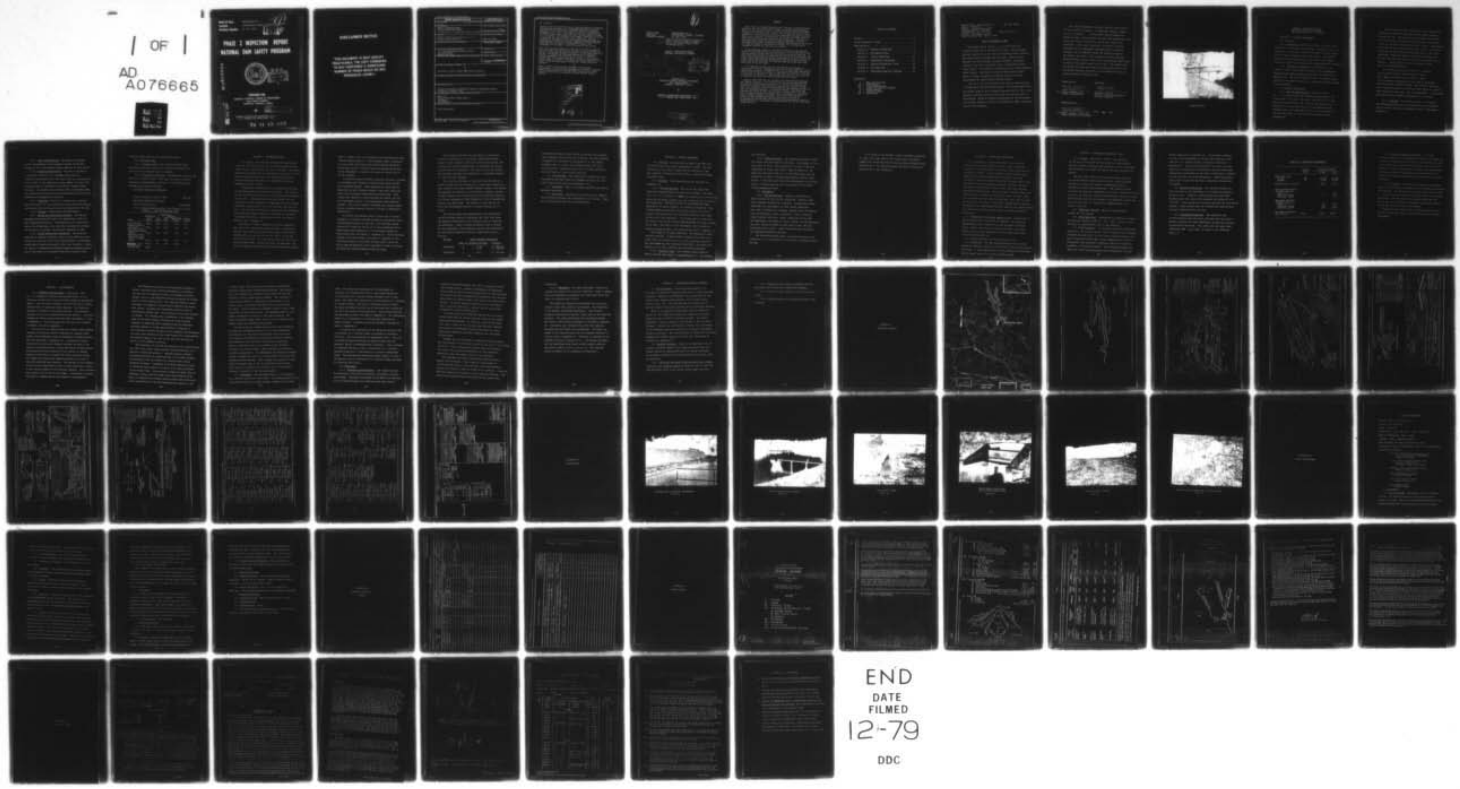

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Name Of Dam: CHERRYSTONE NO. 1

Location: PITTSYLVANIA COUNTY, VIRGINIA

Inventory Number: VA. NO. 14302

LEVEL II

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED FOR

NORFOLK DISTRICT CORPS OF ENGINEERS
803 FRONT STREET
NORFOLK, VIRGINIA 23510

BY

SCHNABEL ENGINEERING ASSOCIATES, P.C./
J. K. TIMMONS AND ASSOCIATES, INC.

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER VA 14302	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Phase I Inspection Report National Dam Safety Program Cherrystone No.1 Pittsylvania County, Virginia		5. TYPE OF REPORT & PERIOD COVERED Final 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Schnabel Engineering Associates, P.C./ J.K. Timmons and Associates, Inc.		8. CONTRACT OR GRANT NUMBER(s) DACW65-79-D-0004
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U. S. Army Engineering District, Norfolk 803 Front Street Norfolk, VA 23510		12. REPORT DATE 13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Copies are obtainable from National Technical Information Service, Springfield, Virginia 22151

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dams - VA
National Dam Safety Program Phase I
Dam Safety
Dam Inspection

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

(See reverse side)

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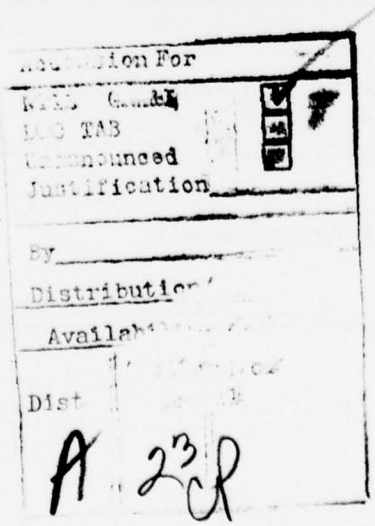
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

20. Abstract

Pursuant to Public Law 92-367, Phase I Inspection Reports are prepared under guidance contained in the recommended guidelines for safety inspection of dams, published by the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general conditions of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

Based upon the field conditions at the time of the field inspection and all available engineering data, the Phase I report addresses the hydraulic, hydrologic, geologic, geotechnic, and structural aspects of the dam. The engineering techniques employed give a reasonably accurate assessment of the conditions of the dam. It should be realized that certain engineering aspects cannot be fully analyzed during a Phase I inspection. Assessment and remedial measures in the report include the requirements of additional indepth study when necessary.

Phase I reports include project information of the dam and appurtenances, all existing engineering data, operational procedures, hydraulic/hydrologic data of the watershed, dam stability, visual inspection report and an assessment including required remedial measures.



(1)

NAME OF DAM: CHERRYSTONE NO. 1
LOCATION: PITTSYLVANIA COUNTY, VIRGINIA
INVENTORY NUMBER: VA. NO. 14302

(6) National Dam Safety Program. Cherrystone Number 1 (Inventory Number VA 14302), Pittsylvania County, Virginia. Phase I Inspection Report.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

(9) Final rept., (P) 76

(10) James A. Walsh

(11) 1979

(15) DACW65-79-D-0004

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of the Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the design flood should not be interpreted as necessarily posing a highly inadequate condition. The design flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

TABLE OF CONTENTS

Name of Dam: Cherrystone No. 1 Va. No. 14302
State: Virginia
County: Pittsylvania County
USGS Quad Sheet: Chatham
Coordinates: Lat 36° 51.0' Long 79° 26.0'
Stream: Cherrystone Creek
Date of Inspection: May 1, 1979

BRIEF ASSESSMENT OF DAM

Cherrystone Creek Dam No. 1 is a zoned earthfill structure about 790 ft long and 57 ft high. The principal spillway consists of a 42 inch prestressed cylinder concrete pipe which extends through the structure. Water is discharged into the principal spillway through a reinforced concrete riser and is expelled into a reinforced concrete impact basin. The emergency spillway is a 135 ft wide vegetated earth channel. The dam is located on Cherrystone Creek about 2.5 miles northwest of Chatham, Virginia and was constructed for flood control and recreation.

The dam is of "intermediate" size and has been assigned a "significant" hazard classification. The appropriate spillway design flood is the ½ Probable Maximum Flood (½ PMF). The emergency spillway will pass 80 percent of the PMF prior to overtopping. Based on criteria established by the Department of the Army, Office of the Chief of Engineers (OCE), the spillway is rated adequate.

The actual embankment structure appears to be similar to the "as built" drawings. A stability analysis summary for the embankment slopes under rapid drawdown and steady seepage conditions was reviewed and assumptions, test data, and resultant factors of safety were found to be acceptable. The visual inspection revealed no apparent problems with the embankment and appurtenant structures and there are no immediate needs for remedial measures. The slopes, the crest of the structure, and the spillway should be mowed several times a year and existing small trees or saplings removed at least once a year. The ponded water and swampy area observed below the right downstream toe of the dam and adjacent abutments is not considered to be related to seepage through the dam.

Submitted by:

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for James A. Walsh, P.E.
Chief, Design Branch

Approved:

Original signed by:
Douglas L. Haller

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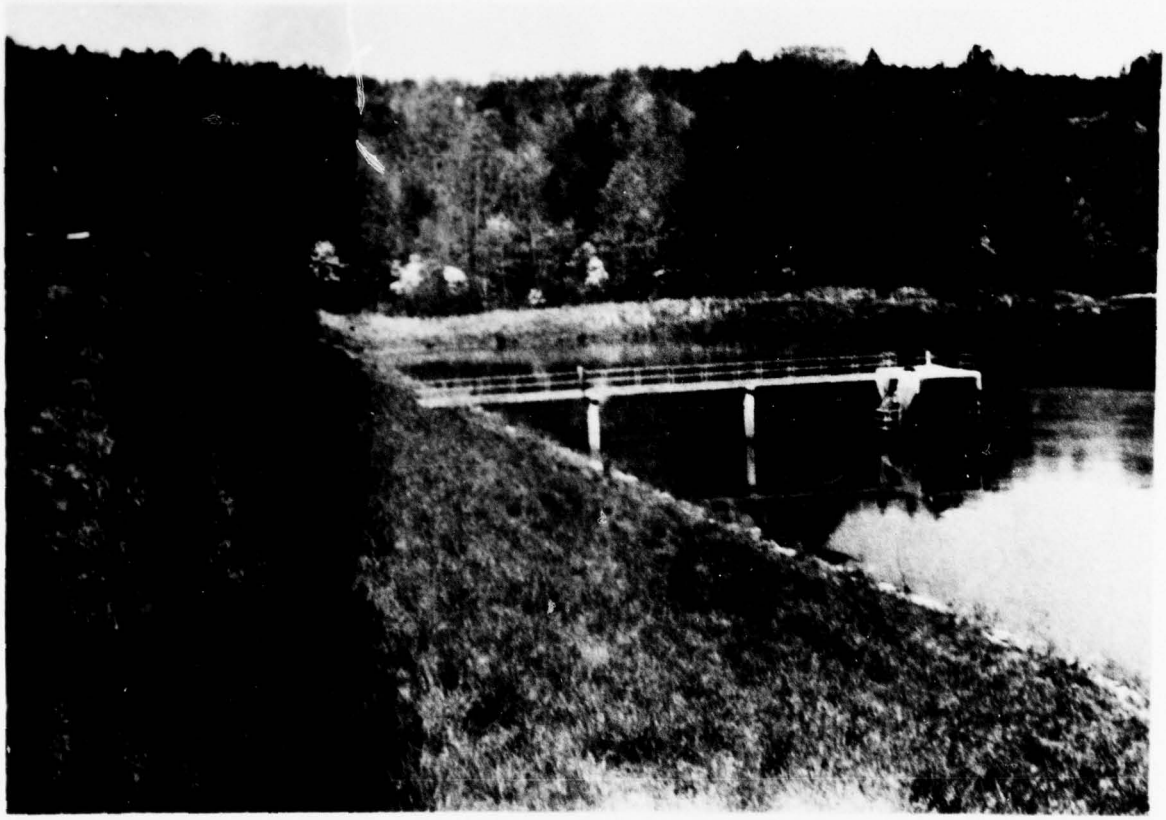
JOHN R. PHILPOTT

for Jack G. Starr , P.E., R.A.
Chief, Engineering Division

Date: AUG 3 1979



OVERVIEW PHOTO

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
CHERRYSTONE DAM NO. 1 VA #14302

SECTION 1 - PROJECT INFORMATION

1.1 General:

1.1.1 Authority: Public Law 92-367, 8 August, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of safety inspections of dams throughout the United States. The Norfolk District has been assigned the responsibility of supervising the inspection of dams in the Commonwealth of Virginia.

1.1.2 Purpose of Inspection: The purpose is to conduct a Phase I inspection according to the Recommended Guidelines for Safety Inspection of Dams (See Reference 1, Appendix VI). The main responsibility is to expeditiously identify those dams which may be a potential hazard to human life or property.

1.2 Project Description:

1.2.1 Dam and Appurtenances: Cherrystone Dam No. 1 is a zoned earth-fill structure approximately 790 ft long and 57 ft high. The top of the dam is 17 ft wide and is at elevation 693.4 ft. M.S.L. Side slopes are 2.5 horizontal to 1 vertical (2.5:1) on the downstream and upstream sides. Ten feet and eight feet wide berms exist on the upstream slope at elevation 658.4 and 666.4 M.S.L., respectively.

The principal spillway consists of a 42 inch diameter prestressed cylinder reinforced concrete pipe, running through the dam. Discharge into the conduit is provided by a reinforced concrete riser with low stage and crest inlets at elevations of 662.4 and 671.5 M.S.L., respectively. The riser has three additional inlets, each at a different elevation, located below the low stage crest. The three additional inlets are used for low flow discharges and to drain the lake and consist of two 12 inch gates at elevations 656.7 and 651.7 M.S.L., and one 36 inch gate at elevation 639 M.S.L.

The emergency spillway, which is a vegetated earth channel having a bottom width of 135 ft, has a crest elevation of 682.1 M.S.L. Most of the emergency spillway is in cut, and is separated from the dam by a broad hillside. The emergency spillway has a vegetative cover in all areas except where an unpaved road crosses the east end, near the impoundment. The spillway has side slopes of about 3 horizontal to 1 vertical.

1.2.2 Location: Cherrystone Dam No. 1 is located on Cherrystone Creek near its juncture with Va. Route 802 and 2.5 miles northwest of Chatham, Virginia, (See Sheet 1, Appendix I).

1.2.3 Size Classification: The dam is classified as an "intermediate" size structure because of the dam height of 57 ft and maximum storage capacity of 7152 acre-ft.

1.2.4 Hazard Classification: The dam is located in a rural and forested area, however, based upon the industrial development and a few homes near the intersection of Va. Route 57 and Cherrystone Creek, about 2.5 miles downstream, the dam is assigned a "significant" hazard classification. The hazard classification used to categorize dams is a function of location only and has nothing to do with its stability or probability of failure.

1.2.5 Ownership: The Town of Chatham has a special land use permit with the Pittsylvania Soil and Water Conservation District for the construction and operation of the dam.

1.2.6 Purpose: Flood Control and Recreation

1.2.7 Design and Construction History: The dam was designed and constructed under the supervision of the U.S. Soil Conservation Service. Responsibility for construction was by the Pittsylvania Soil and Water Conservation District and the Town of Chatham. The dam was completed in 1967.

1.2.8 Normal Operational Procedures: The principal spillway is ungated; therefore, water rising above the crest of the low stage and crest inlet automatically is discharged downstream in quantities based on the inlet capacity. Similarly, water is automatically passed through the emergency spillway in the event of an extreme flood which creates a pool

elevation above that of the emergency spillway.

1.3 Pertinent Data:

1.3.1 Drainage Areas: The original design (SCS) indicated a drainage area of 14.7 square miles which has been verified and found to be reasonable.

1.3.2 Discharge at Dam Site: Maximum known flood at the dam site occurred in June 1972 when the pool reached an elevation of approximately 673 M.S.L. All discharge was through the principal spillway.

Principal Spillway Discharges:

Pool Elevation at Crest of Dam	298 CFS
Emergency Spillway Discharge:	
Pool at Crest of Dam	16,200 CFS

1.3.3 Dam and Reservoir Data: See Table 1.1, below.

Table 1.1 DAM AND RESERVOIR DATA

Item	Reservoir Elevation feet M.S.L.	Area Acres	Capacity Acre Feet	Watershed Inches	Length Miles
Crest of Dam	693.4	342	7152	9.12	2.7
Emergency Spillway Crest	682.1	256	3614	4.61	2.3
Principal Spillway Crest (Crest Inlet)	671.5	120	1418	1.81	2.0
Principal Spillway Crest (Low Stage) (normal pool)	662.4	105	1092	1.39	1.5
Sediment Pool	651.7	52	242	0.31	-
Streambed at toe of Dam	636.2	-	-	-	-

SECTION 2 - ENGINEERING DATA

2.1 Design: The dam was designed and constructed under the direction of the U.S. Soil Conservation Service (SCS) and was sponsored by the City of Chatham. "As built" drawings and design data are available in the office of the State Conservationist, U.S. Soil Conservation Service, Federal Building, Room 9201, 5th and Marshall Streets, Richmond, Virginia 23240.

A subsurface investigation was conducted at the site by the SCS during the initial design stages. The investigation consisted of drilling 13 test borings and excavating 54 test pits. Subsurface profiles and a report of the investigation with foundation recommendations were prepared based upon permeability tests, test borings, and test pit data. The Geologic Investigation Report and the Embankment and Foundation Summary Report are available at the above referenced SCS office. Subsurface profiles are shown on Sheets 6 and 7, Appendix I.

The dam is a zoned, compacted earthfill embankment. The earth fill requirements shown on Sheet 5, Appendix I, specify that clayey silts and clayey sands classified ML and MH and SC be used in the core or Zone 1 of the dam. Soil classification is by the Unified Soil Classification System, ASTM D-2487. On the upstream side and above, the core is blanketed with silty sand classified SM, designated

Zone 3. Zones 1 and 3 are covered on the upstream and downstream slopes by Zone 2, a low permeable shell, consisting of silty sands and clayey sands classified SM and SC-SM. A drainage system is located under the downstream portion of the embankment to control the phreatic surface and to collect seepage.

A review of design drawings indicates the dam is founded on overburden and includes a cutoff trench which extends into weathered bedrock. Both abutments are described as being dry and well drained, however, some drill water was lost in DH-1 and DH-2 during drilling operations. Some seepage was expected to occur beneath the cutoff, but was not considered critical in the Embankment and Foundation Summary. This report further indicated that piping should not be a problem based on criteria included in Reference 5, Appendix VII.

To control the phreatic water surface and to collect seepages, an internal drainage system was constructed along the downstream portion of the dam. This drainage system consists of a total of 310 ft of 10 inch perforated corregated metal pipe enclosed in a 2 ft minimum envelope of coarse drain fill (see Sheet 7, Appendix I). Nine reinforced concrete anti-seep collars (see Sheet 8, Appendix I) were installed around the principal spillway pipes, under the entire dam and spaced at 24 ft intervals in order to control any potential piping problems along the pipes.

The principal spillway was designed as a drop inlet structure consisting of a two-stage reinforced concrete riser, 42-inch diameter reinforced concrete water pipe, and a reinforced concrete impact basin to dissipate the energy of high velocity discharge at the outlet end of the conduit. The emergency spillway was designed as a trapezoidal channel cut into the left abutment.

The emergency spillway is separated from the dam by a broad hillside and was designed as a trapezoidal channel cut into residual soils and weathered bedrock (granite and schist). The spillway is basically in cut material; however, specifications required that the bottom of the spillway be undercut 1 ft and be replaced by fill compacted to 95% of maximum dry density, per ASTM D-698. The length of level section is 30 ft and the maximum velocity of control section is 7.4 ft/sec.

The design report and supplementary data provided by the SCS includes detailed laboratory test data describing the physical properties of the materials used to construct the embankment. Shear strength parameters used in design for the embankment, and foundation material were determined by consolidated undrained triaxial compression tests as follows:

SECTION	SHEAR STRENGTH PARAMETERS	
	Angle of Internal Friction	Cohesion
Embankment	$\phi = 27.5^{o}$	C = 650 psf
	$\phi = 17.5^{o}$	C = 950 psf
Foundation	$\phi = 35.0$	C = 375 psf

The Modified Swedish Circle Method of Analysis was probably used although this could not be verified. The data included in Appendix IV indicates an evaluation of 1) the sudden drawdown case (I), and 2) the steady seepage case (III) were performed. Apparently only total strength parameters were utilized in a total stress analysis.

2.2 Construction: The construction records were not furnished by the SCS office in Richmond, but they are available from the SCS office in Washington, D.C.

2.3 Operation: There is no known operation and instrumentation procedure.

2.4 Evaluation: Engineering calculations are adequate and the design drawings are representative of the dam. There are no records available for dam performance.

SECTION 3 - VISUAL INSPECTION

3.1 General: An inspection was made 1 May 1979 and the weather was fair with a temperature of 70°F. The pool elevation at the time of inspection was 663± M.S.L. and the tailwater elevation was 636.5 M.S.L., which corresponds to normal flows.

3.2 Findings: Field observations are outlined in Appendix III.

3.2.1 Dam and Spillway: The toe of the downstream slope was overgrown with tall grass and included a few small trees (1" to 3" diameter). Otherwise, vegetation on the dam and along the emergency spillway was well maintained at the time of the inspection. The basal 15 ft± of the downstream slope appeared to be moist; however, no seepage was observed. Vegetation commonly associated with poorly drained areas (i.e., cattails and marsh grass) was observed below the right downstream toe of the embankment. The ponded water in this area was found to be fed by a spring downstream of the right abutment of the dam. This water is not considered to be related to seepage through the dam. For locations, see Sheet 3 Appendix I.

The intake is in good conditions. No spalling or cracking was observed. A small amount of debris was noted in the trash rack. The manhole cover is missing from the structure. The gates have not been operated since 1972. The energy dissipator was in good condition and functioning properly.

3.2.2 Reservoir Area: The reservoir area showed no debris and had side slopes of approximately 3:1. No sediment

was observed.

3.2.3 Downstream Area: The downstream channel showed no erosion and minor debris collection. The channel is 15 ft wide and 4 ft deep. Side slopes are 1:1 with a 300± wide floodplain on either side with a slope of about 2:1. No homes were observed close to the site downstream, but the bridge for Rt. 802 is located approximately 3500 ft downstream. A few homes and industrial developments are located about 2.5 downstream near the intersection of Va. Route 57 and Cherrystone Creek.

3.3 Evaluation:

3.3.1 Dam and Spillway: Overall, the dam was in good condition at the time of inspection. However, some minor remedial measures are required. Uncontrolled growth encourages the development of deep rooted vegetation. This type of growth can encourage piping within the embankment and undermine riprap protection. Also, excessive growth inhibits effective visual inspections of the dam. The embankment, including its crest, slopes, and the emergency spillway, should be mowed at least once a year, but more preferably twice a year. Small trees presently growing on the embankment should be removed.

The moisture observed below the downstream toe of the embankment is not considered to be related to seepage through the dam.

It is noted in the geologic report included in Appendix VI, that "The right side of the flood plain is slightly swamped out, which may present some drainage problems during construction." The existing marshy area may be related to this portion of the floodplain.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures: Cherrystone Dam No. 1 is used for recreation and flood control purposes. The normal pool elevation is maintained by a riser-type inlet acting as the principal spillway. During periods of below normal flows, water flow is maintained through the dam by utilizing the two 12 inch gated inlets below the low stage inlet crest. The gated inlets are manually operated, and when the pool elevation is below the low stage inlet crest they provide minimum flow downstream. During periods of normal flows, the pool elevation is above the low stage inlet. Greater flows are discharged through both the low stage inlet and the inlet at the top of the riser. Exceptional inflows which cannot be absorbed by the impoundments storage capacity are passed through the emergency spillway once the pool rises above elevation 682.1 M.S.L.

4.2 Maintenance of Dam and Appurtenances: Maintenance is the responsibility of the Town of Chatham. The operating appurtenances were reported to be and appeared in working order, however they are not routinely checked. The vegetative growth on the embankment has been maintained except along the downstream toe.

4.3 Warning System: No warning system exists.

4.4 Evaluation: The dam and appurtenances are in good operating condition; however, maintenance is not being routinely performed. A semi-annual mowing routine should be established and an annual check of all gates should be made.

SECTION 5 - HYDRAULICS/HYDROLOGIC DATA

5.1 Design: Cherrystone Dam No. 1 was designed by the Soil Conservation Service (SCS) as a multipurpose dam and complete hydrologic and hydraulic data are available. This structure is a Class "B" dam by the SCS classification method.

The low stage inlet crest of the principal spillway was established at elevation 662.4 M.S.L., which provides storage for a 100-year sediment accumulation and for recreation (fishing and aesthetics). The capacity of the principal spillway was established to produce a maximum pool elevation at the emergency spillway crest during a 100-year flood. The emergency spillway is designed to accommodate a flood less than the PMF which is consistent with SCS standards for a Class B structure.

5.2 Hydrologic Records: There are no hydrologic records for this stream.

5.3 Flood Experience: Maximum pool elevation, 673 M.S.L., was observed during a storm in June 1972. A rise in pool elevation of approximately 10.5 ft was observed.

5.4 Flood Potential: In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible), or fractions thereof. The Probable Maximum Flood (PMF) and ½ PMF flood hydrographs were developed by the SCS

method (Reference 4, Appendix VI). Precipitation amounts for the flood hydrographs of the PMF and ½ PMF were taken from the U. S. Weather Bureau information (Reference 5, Appendix VI). Appropriate adjustments for basin size and shape were accounted for and emergency spillway hydrograph determination procedures as outlined in Reference 5, Appendix VI were used for the flood hydrographs. These hydrographs were routed through the spillway to determine maximum pool elevations.

5.5 Reservoir Regulation: For routing purposes the pool elevation at the beginning of the flood was assumed to be 662.5 M.S.L. Reservoir stage-storage data and stage-discharge data were taken from available SCS hydraulic calculations. Flow through the principal spillway was used during routing. Stage-storage data was extrapolated from SCS data for pool elevations above the dam.

5.6 Overtopping Potential: The predicted rise of the reservoir pool and other pertinent data were determined by routing the flood hydrographs through the reservoir as previously described. The results for the three flood conditions (PMF and ½ PMF) are shown in the following Table 5.1.

TABLE 5.1 RESERVOIR PERFORMANCE

	Normal Flow	Flood Hydrograph	
		½ PMF	PMF
Peak Flow, CFS			
Inflow	15±	20,895	41,789
Outflow	8±	6,250	25,815
Maximum Elev. ft M.S.L.		688.3	695.3
Non-overflow Section (EL 693.4 M.S.L.)			
Depth, ft		-	1.9
Duration, hours		-	3.0
Velocity, fps**		-	5.9
Emergency Spillway (EL 682.1 M.S.L.)			
Depth, ft		6.1	13.2
Duration, hours		18	21
Velocity, fps**		4.09	12.76
Tailwater Elevation (ft, M.S.L.)	636.5	646.2	651.7

5.7 Reservoir Emptying Potential: A 36 inch circular head gate at elevation 639.0 M.S.L. will drain the reservoir through the 42 inch pipe. Assuming that the lake is at normal pool elevation (662.5 M.S.L.) and an average inflow of 15 CFS is maintained, it would take approximately 4.5 days to lower the reservoir to elevation 640 M.S.L. There are no methods for lowering the reservoir below this elevation.

5.8 Evaluation: Hydrologic and hydraulic determinations of the project as prepared by the SCS appear reasonable and accurate. The appropriate spillway design flood is the ½ PMF due to the "significant" hazard conditions existing downstream. The dam will be overtopped during the PMF by 1.9 ft, but the emergency spillway will pass 80 percent of the PMF before the dam is overtopped.

Hydrologic data used in the evaluation pertain to present day conditions with no consideration given to future development.

SECTION 6 - DAM STABILITY

6.1 Foundation and Abutments: Cherrystone Dam No. 1 is founded on alluvial and residual soils, all of which are underlain by rocks previously mapped as Wissahickon Schist. The structure includes a 20 ft± wide cutoff trench, which extends to weathered schist bedrock. The principal spillway is founded on this same material. The emergency spillway is cut into weathered schist and granite. "As built" drawings of these various areas are shown on Sheets 3, 4 and 5, Appendix I. The test boring and test pits are included as Sheets 9, 10 and 11, Appendix I.

The dam site is located within the Piedmont Physiographic Province of Virginia, which is underlain by igneous, metamorphic and sedimentary rocks of Precambrian through Triassic Age (see Reference 3, Appendix VI). Pittsylvania County lies entirely within the Piedmont Province and most of the county is characterized by a broad and gently rolling plateau. This plateau has been dissected into a series of complex slopes by the action of streams and other erosional agents. The slopes are rounded and commonly mantled by a layer of soil and weathered rock material. The geology of the Piedmont is not as well understood as that of other provinces, because of the limited number of rock outcrops exposed. Thick residual soil covers of up to 100 ft are common. Furthermore, geologic structure is complicated by the effects of metamorphism.

The Chatham area has not been geologically mapped in detail, therefore only limited information is available. The dam site is underlain by what is believed to be metamorphic rocks of the Wissahickon Schist Formation of Precambrian or Early Cambrian Age. The detailed geologic report describes the bedrock as consisting of phyllite and garnet mica schist, intruded with feldspathic granite dikes of considerably younger age. The thickness of the rock sequence is unknown. No outcrops were encountered in the abutment areas of the dam; however, foliation or slaty cleavage examined in weathered schist exposed along the emergency spillway appears to strike approximately 45 degrees to the northeast and dips variably to the southeast and northwest. No faults were observed in the field during this investigation and geologic maps of the area do not show the presence of faults in the immediate vicinity.

The centerline of the dam was reported to be characterized by a thin soil cover, which overlies weathered bedrock (i.e. phyllite, schist and granite). Residual granite boulders encountered beneath the ground surface in the right abutment are believed to be the remains of a granite dike, which weathered in-place. Floodplain or alluvial deposits ranging in thickness from several ft to about 15 ft were penetrated in the valley floor. The alluvium includes an upper layer of nonplastic silty sands and sandy silts classified SM to ML, which is underlain by slightly plastic silty clays and clayey silts classified CL to ML with discontinuous layers of fine

to coarse sand. All soils were classified in accordance with the Unified Soils Classification System. The alluvial soils are underlain by residual soils, which are derived from the in-place weathering of bedrock. The residuum is essentially nonplastic, consisting of micaceous, fine to coarse sands, silty sands and sandy silts classified SM, SP and ML. Limited amounts of slightly plastic clayey sands classified SC were also present. The maximum amount of overburden encountered was 90 ft in the right abutment. The depth to bedrock ranged from a few ft to 90 ft and the overburden became less weathered with depth.

The potential for seepage exists within the foundation. Although the floodplain deposits are of low permeability, the presence of scattered discontinuous layers or lenses of permeable sand provides a medium for potential seepage. Both abutments were dry during test boring operations; however, some water loss was recorded in DH-1 and DH-2. Pressure test results made in these borings are presented on Sheet 10, Appendix I. The Embankment and Foundation Summary Report concluded the need for an impermeable core keyed into weathered schist bedrock. Some seepage was expected to occur below the cutoff, but it was not believed to be critical with respect to stability of the base, loss of beneficial storage or capacity of the drainage system.

6.2 Embankment: The upstream slope is 2.5 horizontal to 1 vertical with crest at EL 693.4. At elevation 666.4 M.S.L. the slope flattens to a level surface, forming a $7\pm$ ft wide

berm. The slope then continues at 2.5 horizontal to 1 vertical. At elevation 658.4 M.S.L. the slope flattens to 12 horizontal to 1 vertical surface forming a 12± ft wide berm. The slope then continues to 2.5 horizontal to 1 vertical to natural ground. The slope is blanketed with 24 inches of riprap extending from the top of the upper berm (elevation 666.4)to the center of the lower berm. Riprap specifications are presented as Note 1 of Sheet 5, Appendix I. The downstream slope is 2.5 horizontal to 1 vertical and terminates at natural ground. A typical section of the dam is included on Sheet 5, Appendix I.

A sloping core consisting of ML, MH and SC material with 1 horizontal to 1 vertical slope is provided to elevation 670 M.S.L. The core material is designated Zone 1. The core is blanketed above and along the upstream slope with SM material, which is designated Zone 3 material. Zone 3 extends to elevation 682 M.S.L. with a 2 horizontal to 1 vertical upstream slope and a 1 horizontal to 1 vertical downstream slope. The upstream and downstream shells consist of Zone 2 SM material with 2.5 horizontal to 1 vertical slopes provided to elevation 693.4 M.S.L.

6.3 Evaluation:

6.3.1 Foundation and Abutments: Dam foundations must be evaluated on the basis of potential settlement, sliding and seepage. Excessive settlement of the dam is not believed to be a problem because the structure rests upon fairly

competent weathered bedrock and firm to compact alluvial and residual soils. Gradual consolidation of underlying soils would be expected during application of fill materials. The underlying soils probably had essentially fully consolidated under the applied load at the end of the construction period. "As built" drawings show the top of constructed dam at elevation 695± M.S.L. and the top of settled dam estimated at elevation 693.4 M.S.L.

Sliding within the foundation bedrock does not appear likely based upon the design load the nature of the underlying weathered bedrock. In addition, brief field inspection and a review of the geologic data does not indicate the presence of adversely oriented weak planes or zones within the foundation rock that would act as a potential sliding plane.

Seepage was not considered a problem in design because the orientation of the dam was different than that of the bedrock foliation. Since construction reports were not available for review, an accurate determination of the foundation conditions under the cutoff trench is not possible.

The emergency spillway is separated from the dam by a broad, steep hillside. Side slopes of 3 horizontal to 1 vertical have been cut into residual soils and weathered granite and schist to form the sides of the spillway. Compacted fill was required at both ends of the emergency spillway. The slopes were considered safe and stable at the time of the

inspection.

6.3.2 Embankment: No undue settlement, cracking or seepage was noted at the time of inspection, Thus it appears that the embankment is adequate for normal pool level with water at elevation 662.4 M.S.L.

The stability analysis was performed with a section slightly lower than actually constructed. The difference is not however considered significant. The strength parameters described in Section 2 were used in the stability analysis. The report describing the engineering design data used in the stability analysis is included in Appendix IV. These data were reviewed along with the stability analyses and were found to be acceptable. The factor of safety of the upstream slope for the drawdown condition is 1.69 as given in Appendix IV. Reference 1, Appendix VI recommends a factor of safety of 1.2. The factor of safety for the downstream slope under steady seepage condition with drain (shell) at c/b = 0.6 is 2.1. The required factor of safety is 1.5 according to Reference 1.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment: The Cherrystone Dam No. 1 at the time of inspection appeared sound and in a safe operating condition. Based on "intermediate" size classification and "significant" hazard classification, the spillway design flood is the ½ PMF. The spillway will pass 80 percent of the PMF without overtopping the dam and is considered adequate.

There is no apparent problem that requires immediate action for the normal pool conditions based on the visual inspection and a review of existing records. The actual embankment structure appears to be similar to the "as built" drawings. Without the construction records, the conformance of the embankment material properties to design requirements cannot be assessed. The design factors of safety for the rapid drawdown and steady seepage cases meet the requirement of Reference 1, Appendix VI.

7.2 Remedial Measures: There is no immediate need for remedial measures; however, the following maintenance procedures should be implemented within 12 months and should be included in addition to existing annual maintenance items and procedure.

7.2.1 The grass and weeds along the dam crest, slopes, and within the emergency spillway should be cut at least once and preferably twice a year in the early summer and fall.

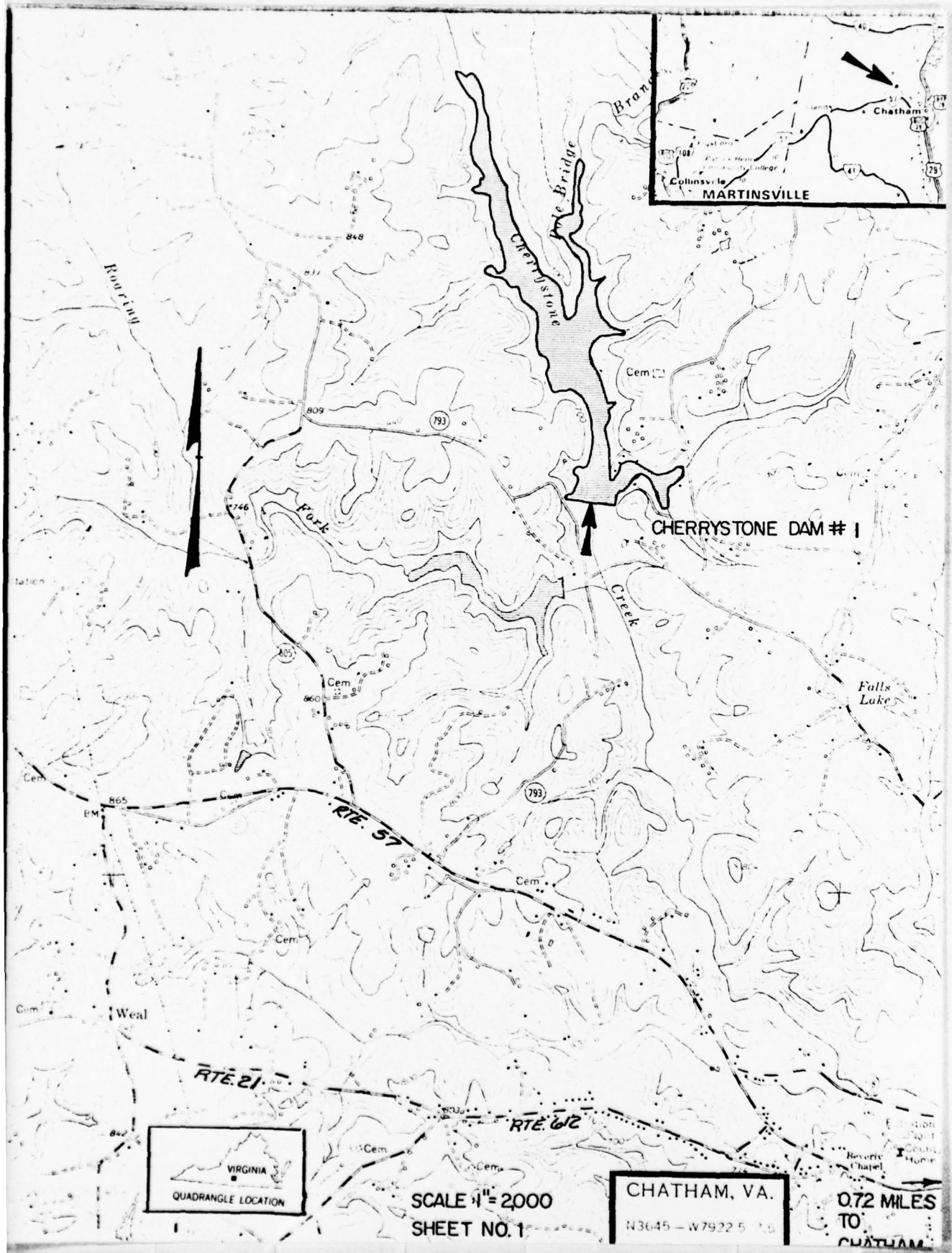
7.2.2 Removal of all trees or saplings from the described areas should be accomplished annually.

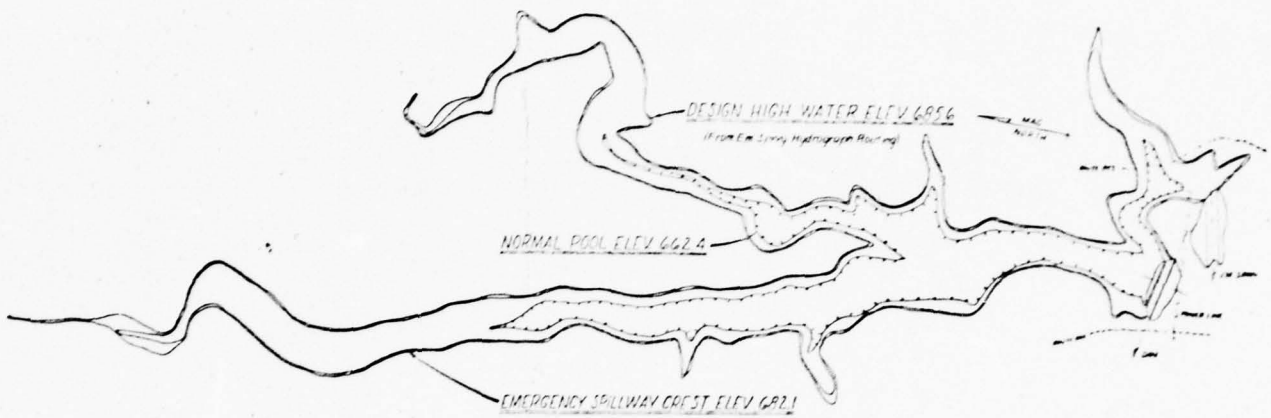
7.2.3 Install a staff gauge to monitor high water levels.

7.2.4 Replace manhole on principal spillway inlet structure.

APPENDIX I

MAPS AND DRAWINGS


Chatham
Collinsville
MARTINSVILLE
Cherrystone
Pole Bridge
Roaring
Fork
Creek
CHERRYSTONE DAM # 1
Falls Lake
RTE. 57
RTE. 21
RTE. 62
Weal
Cem
793
809
848
746
805
865
860
VIRGINIA
QUADRANGLE LOCATION
SCALE 1" = 2000
SHEET NO. 1
CHATHAM, VA.
N3645 — W7922 5
0.72 MILES
TO



NOTE
For baseline layout see Sheets 2, 6 and 7

"AS BUILT"

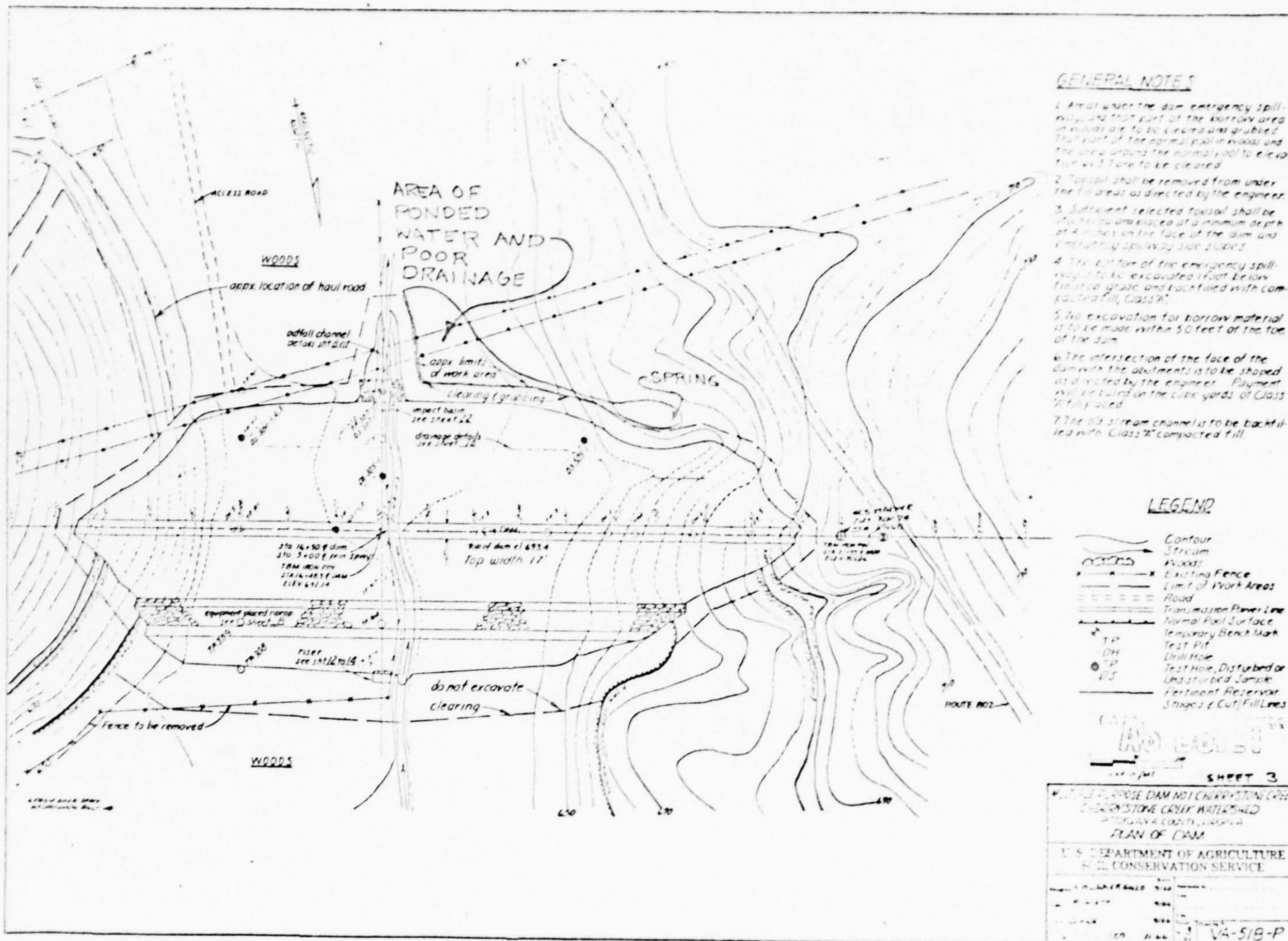
SHEET 2

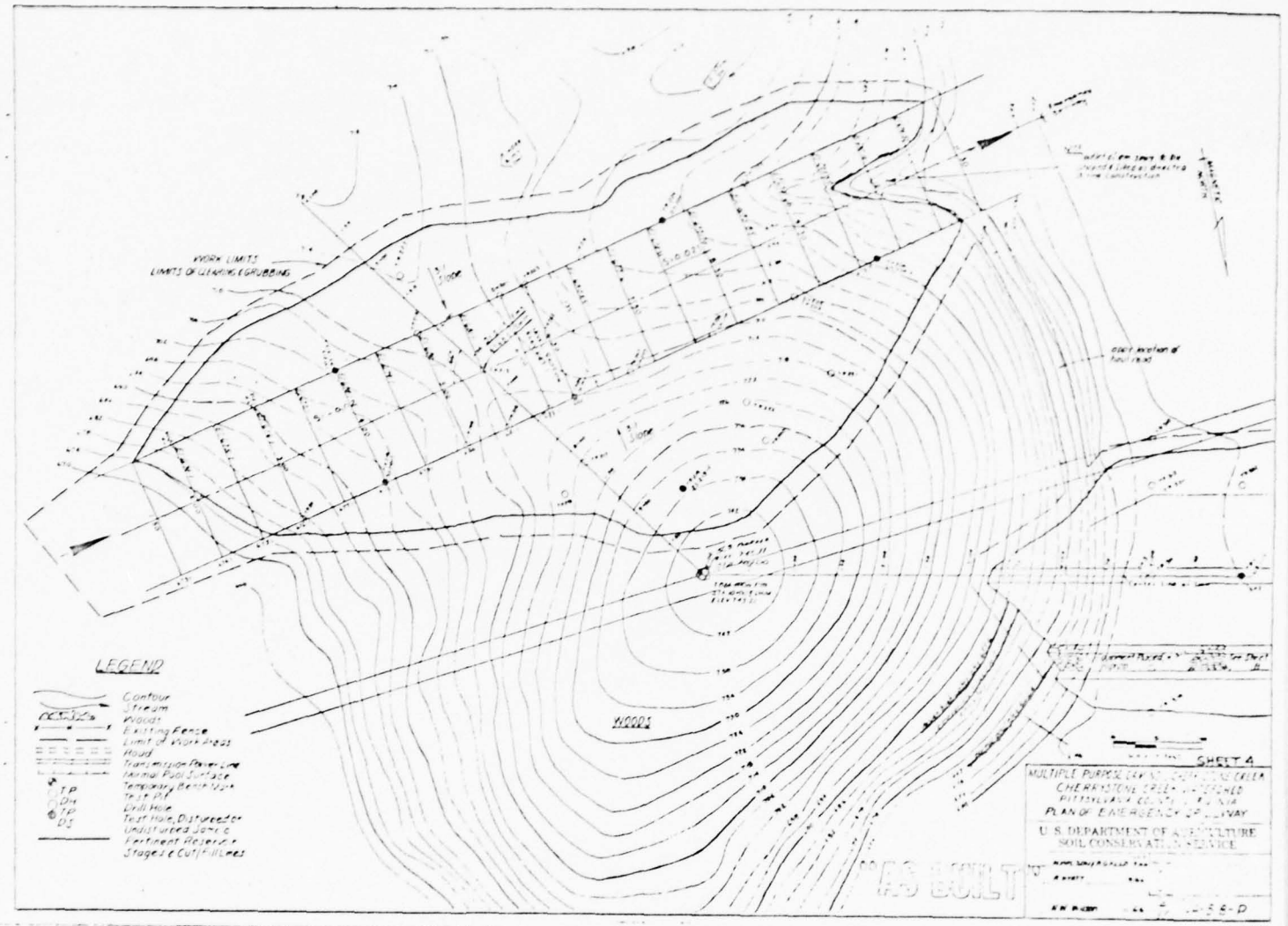
MULTIPLE PURPOSE DAM NO. 1
CHERRYSTONE CREEK WATERSHED
PITTSYLVANIA COUNTY, VIRGINIA
RESERVOIR AREA MAP

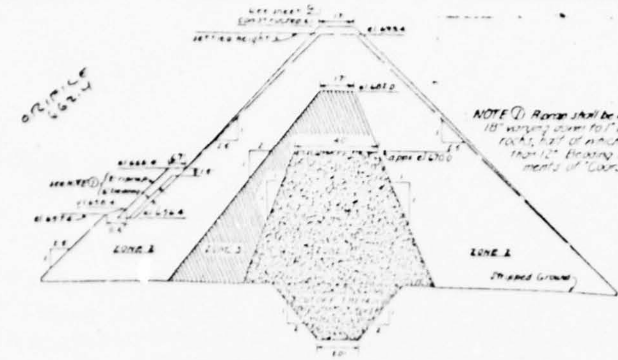
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

H.R. Wilson

VA-518-P


AREA OF PONDED WATER AND POOR DRAINAGE
WOODS
appx location of haul road
ACCESS ROAD
outfall channel details sht 8
appx limits of work area
clearing & grubbing
impact basin see sheet 22
drainage details see sheet 22
SPRING
Top width 17'
equipment placed riprap
riser see sht 12 to 14
do not excavate
clearing
fence to be removed
ROUTE 602
GENERAL NOTES
2. Topsoil shall be removed from under the fill areas as directed by the engineer.
5. No excavation for borrow material is to be made within 50 feet of the toe of the dam.
7. The old stream channel is to be backfilled with Class "A" compacted fill.
LEGEND
Contour
Stream
Woods
Existing Fence
Limit of Work Areas
Road
Transmission Power Line
Normal Pool Surface
Temporary Bench Mark
Test Pit
Drill Hole
Test Hole, Disturbed or Undisturbed Sample
Pertinent Reservoir Stages & Cut/Fill Lines
SHEET 3
CHERRYSTONE CREEK WATERSHED
PLAN OF DAM
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
VA-518-P


WORK LIMITS
LIMITS OF CLEARING & GRUBBING
WOODS
LEGEND
Contour
Stream
Woods
Existing Fence
Limit of Work Areas
House
Transmission Power Line
Normal Pool Surface
Temporary Bench Mark
Test Pit
Drill Hole
Test Hole, Disturbed or
Undisturbed Sample
Pertinent Reference
Stage-Discharge Curve
SHEET 4
MULTIPLE PURPOSE FLOOD CONTROL
CHERRYSTONE CREEK WATERSHED
PITTSYLVANIA COUNTY, VIRGINIA
PLAN OF EMERGENCY SPILLWAY
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
AS BUILT

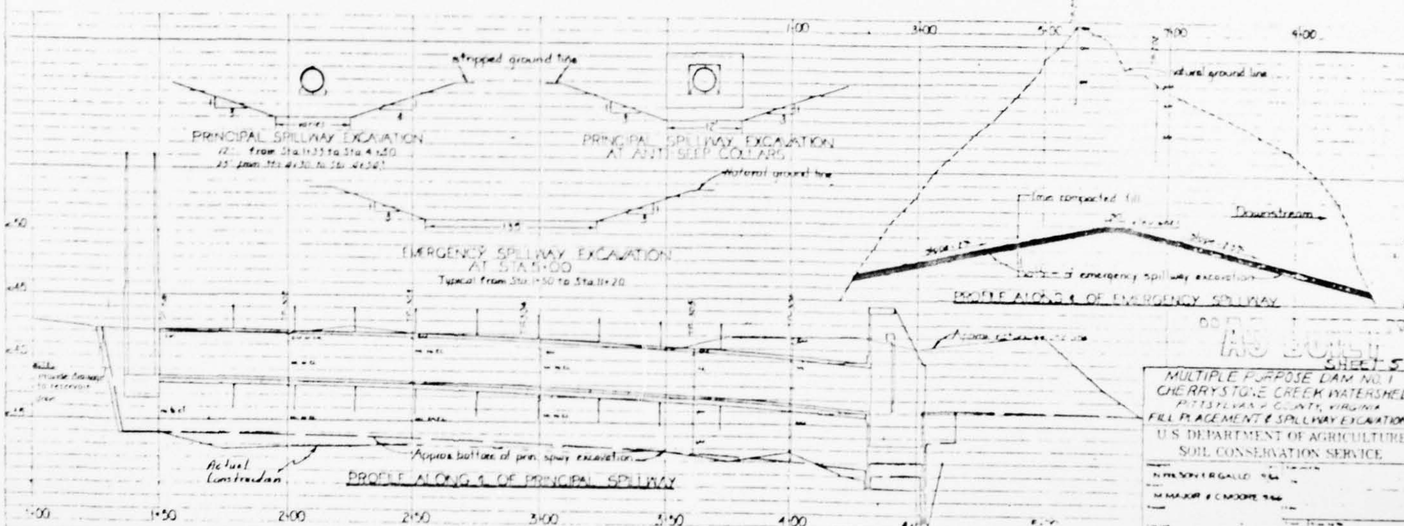


TYPICAL SECTION OF EMBANKMENT AT STA 15+00

EARTH FILL REQUIREMENTS						
ZONE	MATERIAL	MAX ROCK SIZE	MAX * LIFT	REQ'D ** WATER CONTENT	COMPACTION *** CLASS	COMPACTION *** DEFINITION
1	Silty sands (SM) from the emergency spillway represented by material in TP 21, 1-5 and TP 21, 1-12	6"	9"	-1% to +3% of optimum	A	95% max density by ASTM D698 method A
1	Clayey sands (SC) from the emergency spillway represented by material in TP 213, 1-7	6"	9"	-1% to +3% of optimum	A	"
2	Non plastic silty sands (SM) from the emergency spillway represented by mat'l in TP 20, 1-12, TP 24, 1-5, TP 24, 1-12	6"	9"	-3% to +3% of optimum	A	"
2	Silty sands (SM) from borrow area "A" represented by material in TP 106, 1-6	6"	9"	-3% to +3% of optimum	A	"
3	Low plastic silty sands (SM) from borrow area "A" represented by material in TP 103, 1-8	6"	9"	-2% to +3% of optimum	A	"
3	Silty sands (SM) & clayey sands (SC-SM) from borrow area "B" rep by mat'l in TP 108, 1-16, TP 102, 1-5	6"	9"	-2% to +3% of optimum	A	"

* Maximum lift thickness prior to compaction
** Water content at time of placement
*** For typical compaction curves see Sheet 25

NOTE: The foundation surface throughout the base area of the dam shall be scarified to a depth of 6" and compacted prior to placement of material.



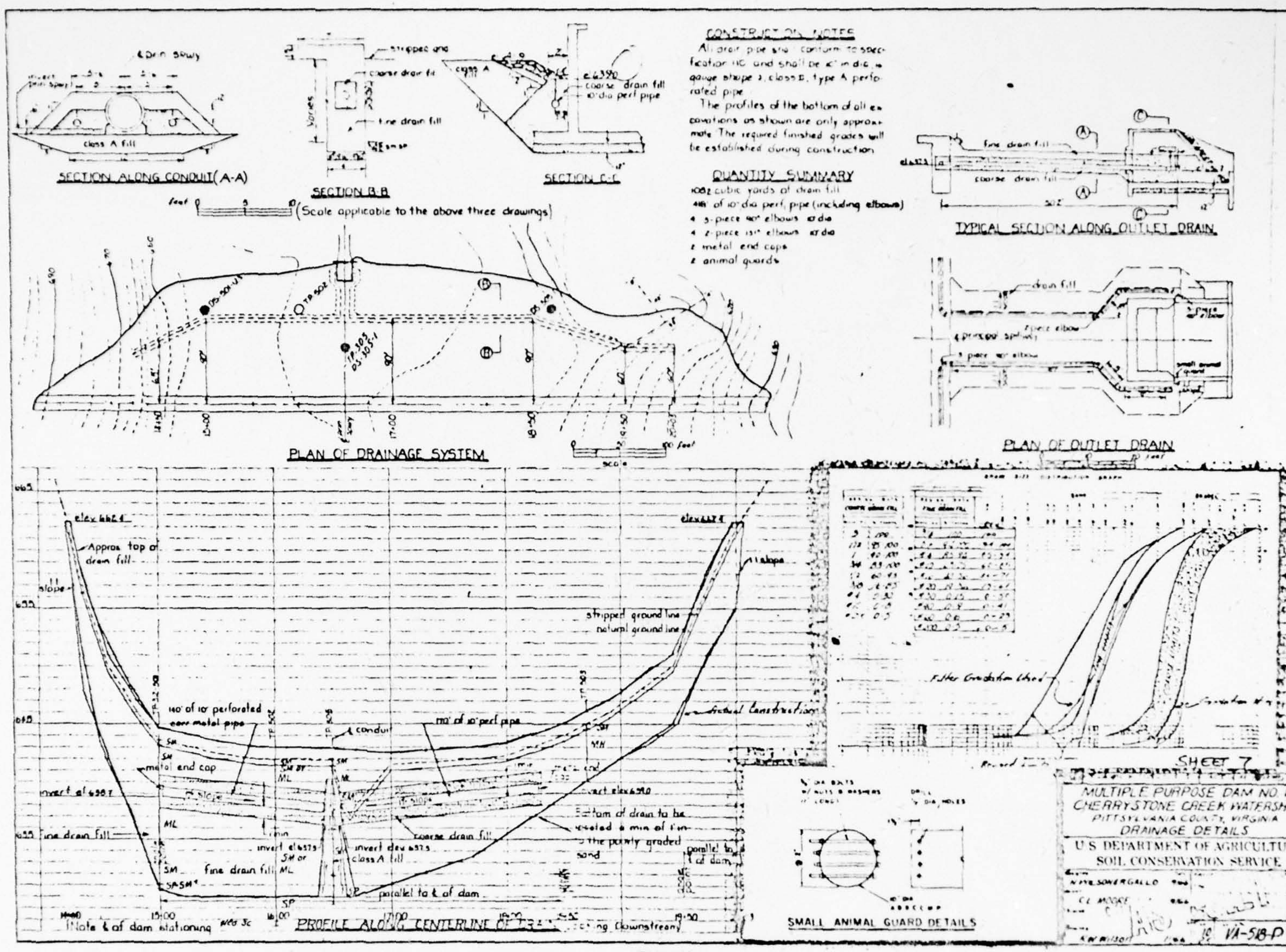
AS BUILT

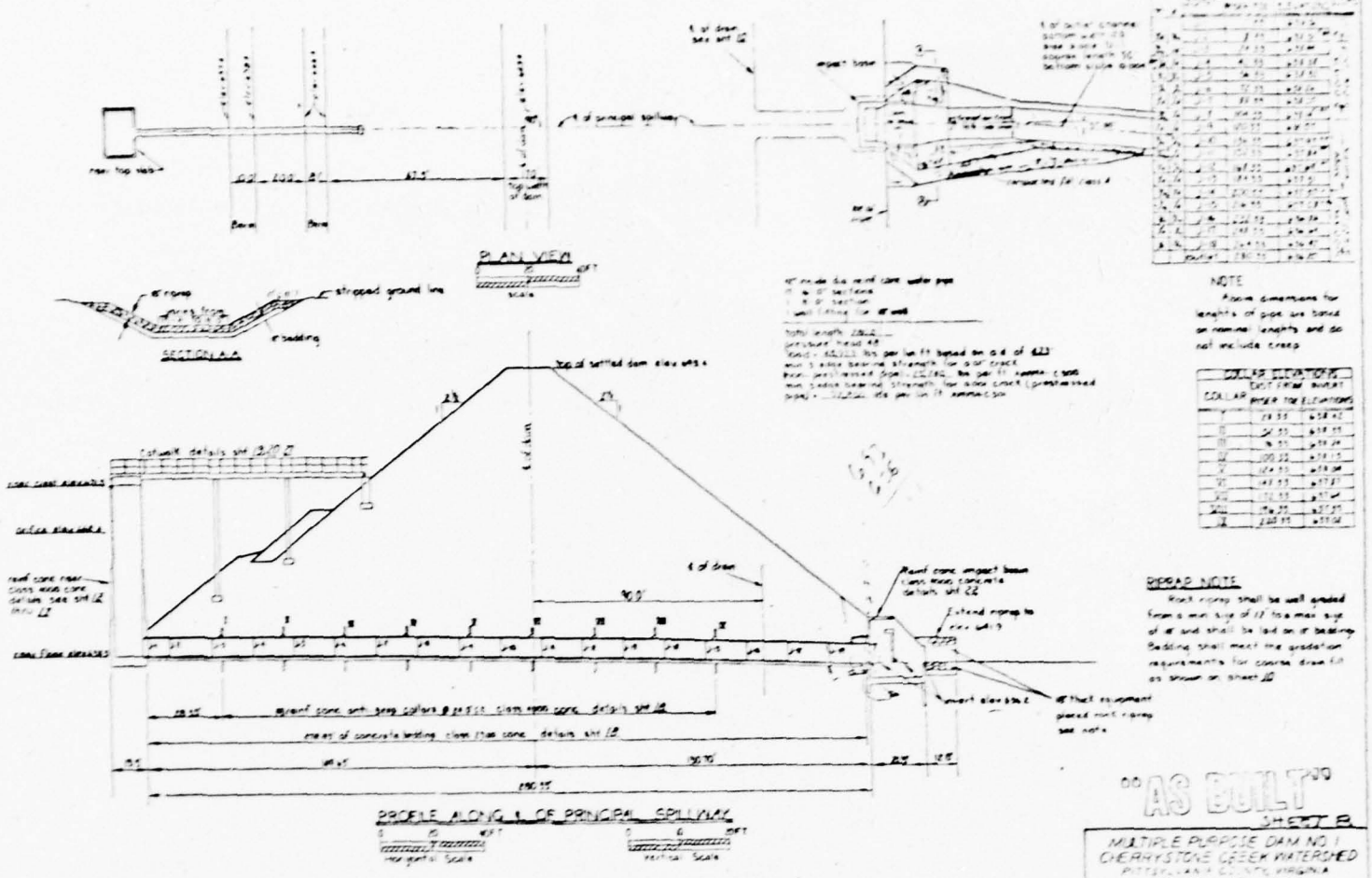
SHEET 5

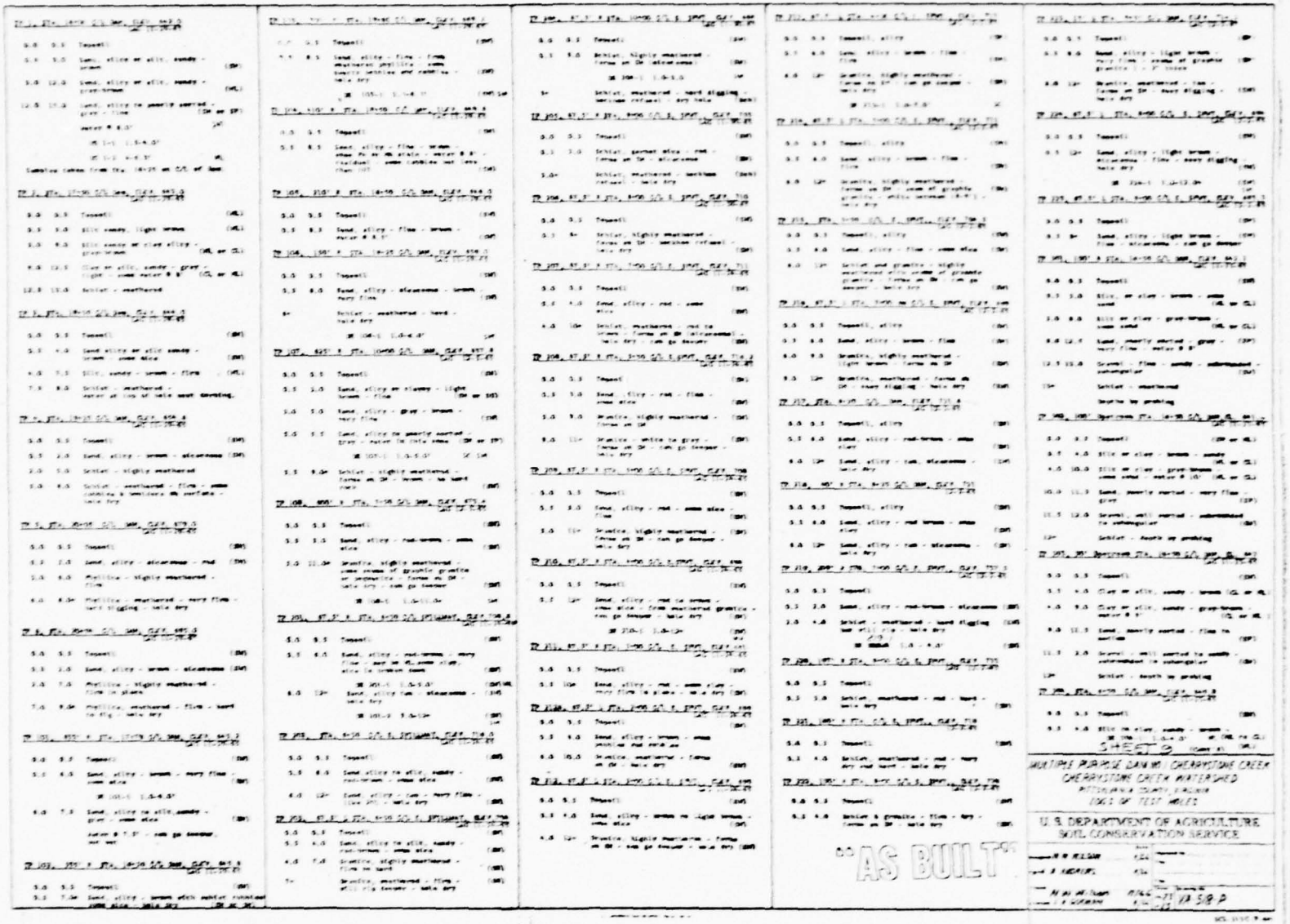
MULTIPLE PURPOSE DAM NO. 1
CHERRYSTONE CREEK WATERSHED
PITTSYLVANIA COUNTY, VIRGINIA
FILL PLACEMENT & SPILLWAY EXCAVATIONS

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

VA 518-P


SECTION ALONG CONDUIT (A-A)
SECTION B-B
SECTION C-C
(Scale applicable to the above three drawings)
CONSTRUCTION NOTES
All drain pipe shall conform to specification 10C and shall be 10" in dia. gauge shape 2, class II, type A perforated pipe.
The profiles of the bottom of all excavations as shown are only approximate. The required finished grades will be established during construction.
QUANTITY SUMMARY
1082 cubic yards of drain fill
of 10" dia perf. pipe (including elbows)
5-piece 90° elbows 10" dia
2-piece 15° elbows 10" dia
metal end caps
animal guards
TYPICAL SECTION ALONG OUTLET DRAIN
fine drain fill
coarse drain fill
PLAN OF DRAINAGE SYSTEM
PLAN OF OUTLET DRAIN
Approx. top of drain fill
stripped ground line
natural ground line
110' of 10" perforated corr. metal pipe
110' of 10" perf pipe
metal end cap
conduit
coarse drain fill
fine drain fill
invert elev 657.5
class A fill
parallel to ℄ of dam
PROFILE ALONG CENTERLINE OF DRAINS
Filter Gradation Chart
SMALL ANIMAL GUARD DETAILS
SHEET 7
MULTIPLE PURPOSE DAM NO. 1
CHERRYSTONE CREEK WATERSHED
PITTSYLVANIA COUNTY, VIRGINIA
DRAINAGE DETAILS
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
VA-518-P


PLAN VIEW
SECTION A-A
PROFILE ALONG ℄ OF PRINCIPAL SPILLWAY
NOTE
RIPRAP NOTES
"AS BUILT"
SHEET 8
MULTIPLE PURPOSE DAM NO. 1
CHERRYSTONE CREEK WATERSHED
PRINCIPAL SPILLWAY
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
VA 518-P


"AS BUILT"
MULTIPLE PURPOSE DAM #1 CHERRYSTONE CREEK
CHERRYSTONE CREEK WATERSHED
PITTSYLVANIA COUNTY, VIRGINIA
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

TP 304 (Cont'd)

4.0	8.0	Silt to clay - gray-brown - some sand - water @ 5'	(ML to CL)
		US 304-2 4.0-8.0'	ML
8.0	12.5	Sand, poorly sorted - some gravel	(SP)
		US 304-3 8.0-12.5	SM
12.5	13.0	Gravel, well sorted - subrounded to subangular	(GW)
13+		Schist (depth by probing)	

TP 305, 80' Downstream STA. 14+5 C/L, ELEV. [illegible]
CAS 11-23-83

0.0	0.5	Topsoil	(SM)
0.5	3.0	Silt, sandy - brown	(ML)
3.0	6.0	Sand, silty - gray - brown - fine - 20% silt	(SM)
6.0	10.0	Sand, silty - gray - fine - 20 - 40% silt - water @ 6'	(SM) SM
		US 305-1 6.0-10.0'	
10.0	12.5	Sand, poorly sorted - fine	(SP)
12.5+		Schist, weathered (depth by probing)	

TP 306, 100' Downstream STA. 14+50 C/L DAM, EL. [illegible]
CAS 11-23-83

0.0	0.5	Topsoil	(SM)
0.5	4.0	Silt, brown - sandy	(ML)
4.0	10.0	Sand, silty - gray - fine - water @ 5'	(SM)
10.0	12.5	Sand, poorly sorted - coarse	(SP)
12.5+		Schist, weathered - (depth by probing)	

TP 307, 100' Downstream STA. 14+50 C/L DAM, EL. [illegible]
CAS 11-23-83

0.0	0.5	Topsoil	(SM)
0.5	4.0	Silt, brown - sandy	(ML)
4.0	10.0	Silt or clay - gray-brown - water @ 5'	(ML or CL)
10.0	12.0	Sand, poorly sorted - medium to coarse	(SP) SP
		US 307-1 10.0-12.0'	
12.0	12.5	Gravel, well sorted to silty - some weathered schist	(GW)
12.5+		Schist, weathered (depth by probing)	

TP 308, 100'/Upstream STA. 13+00 C/L DAM, ELEV. [illegible]
CAS 11-24-83

0.0	0.5	Topsoil	(SM)
0.5	3.0	Sand, silty - brown - very fine	(SM)
3.0	8.5	Silt, sandy - brown to gray-brown - water @ 5'	(ML)
8.5	12.5	Sand, silty - gray brown - very fine	(SM)
12.5	13.0	Sand, poorly sorted to silty - medium	(SP)
13+		Schist, weathered (depth by probing)	

TP 309, 100' Upstream STA. 13+00 C/L DAM, ELEV. [illegible]
CAS 11-24-83

0.0	0.5	Topsoil	(SM)
0.5	3.0	Sand, silty to silt, sandy - brown	(SM or ML)
3.0	5.0	Silt, sandy to sand, silty	(SM or ML)
5.0	14.0	Sand, silty - gray brown - very fine - water @ 5'	(SM)
14.0	15.0	Sand, silty to poorly sorted - very fine	(SM)
15+		Schist - (depth by probing)	

TP 310, 100' Downstream STA. 13+00 C/L DAM, EL. [illegible]
CAS 11-24-83

0.0	0.5	Topsoil	(SM)
0.5	2.5	Sand, silty - brown - fine	(SM)
2.5	7.5	Sand, silty to silt, sandy - gray brown	(SM or ML)

(Cont'd)

7.5	12.5	Sand, silty - gray - very fine - water @ 7'	(SM)
12.5	13.0	Schist, weathered	
13+		Schist, weathered - (depth by probing)	

TP 311, STA. 13+00 on C/L DAM, ELEV. [illegible]
CAS 11-28-83

0.0	0.5	Topsoil	(SM)
0.5	2.5	Sand, silty - brown - very fine	(SM)
2.5	9.0	Silt, sandy - brown to gray - water @ 5'	(ML)
9.0	10.5	Schist, weathered	
10.5+		Schist, weathered	

TP 312, 301 / 100' Downstream STA. 13+00 C/L DAM, EL. [illegible]
CAS 11-28-83

0.0	0.5	Topsoil	(SM)
0.5	4.0	Sand, silty - brown - fine	(SM)
		US 301-1 1.0-4.0'	(SP or SM) SM
4.0	9.0	Silt, sandy - sand, silty - gray brown - water @ 5'	(SM or ML)
		US 301-2 4.0-9.0	(ML) ML
9.0	12.5	Sand, silty - gray brown - very fine	(SM)
		US 301-3 9.0-12.5	(SP) SP-SM
12.5	13.0	Schist, weathered	
13.0+		Schist, weathered - (depth by probing)	

TP 303, 100' Lt STA. 14+00 C/L DAM, ELEV. [illegible]
CAS 11-28-83

0.0	0.5	Topsoil	(SM)
0.5	6.0	Sand, silty or silt, sandy - brown - very fine	(SM or ML)
6.0	12.0	Sand, silty or silt, sandy - gray-brown - water @ 5'	(SM or ML)
12.0	14.0	Sand, poorly sorted to silty - fine to medium - gray	(SP)
14.5+		Schist, weathered - (depth by probing)	

TP 305, 100' Lt STA. 14+70 C/L DAM, ELEV. [illegible]
CAS 12-1-83

0.0	0.5	Topsoil	(SM)
0.5	3.0	Sand, silty to silt, sandy - brown - very fine	(SM or ML)
3+		Rock, water on top of rock	
		US 305-1 1.0-3.0'	(SM)

DH 1, STA. 12+40 C/L DAM, ELEV. [illegible]
CAS 1/5-6/84

0.0	4.0	Sand, silty - brown - some mica	(SM)
		Blow count 3.5' 25	
4.0	25.0	Schist, weathered, mica	
		10-11' 18	
		No casing, no water loss. Thin seams of weathered granite - garnets present, below 15'	
		15-16' 40; 20-21' 45	
		Tried to take split spoon sample - no penetration 25' 100	
		Put in 25 feet of NX flush joint casing	
25.0	42.3	Garnet mica schist, some weathering	25'-28' 47%
			28-31' 43%
		Set casing to 32.3'	31-33' 83%
			33-35.2' 96%
			35.2-39.0' 55%
			39.0-42.3 84%
42.3	56.0	Phyllite, slaty with quartz veins and some pyrite	42.3-46.5 100%
			46.5-50.2 100%
			50.2-56.0 100%

Water Pressure Tests

40.0-45.0'	0.3 gpm @ 10 psi	
	1.0 gpm @ 20 psi	
	4.3 gpm @ 30 psi	
	5.0 gpm @ 40 psi	
	7.0 gpm @ 50 psi	
	5.3 gpm @ 40 psi	
	3.3 gpm @ 30 psi	
	2.3 gpm @ 20 psi	
	2.0 gpm @ 10 psi	
39.0-40.0'	13.0 gpm @ 10 psi	
	14.0 gpm @ 20 psi	
	19.0 gpm @ 30 psi	
	13.0 gpm @ 20 psi	
	13.0 gpm @ 10 psi	

DH 2, STA. 19+75 C/L DAM, ELEV. 468.0
CAS 1/5-6/84

0.0	3.0	Sand, silty - brown - micaceous	
		Blow count 3-6' 9	
3.0	11.0	Schist, highly weathered	
		10-11' 29	
11.0	36.0	Schist, weathered garnet mica	
		13-14' 8	
		Tried to core 13' - 18	0% Rec.
		Set 18' of flush joint NX casing	
		Tried to core 18-20'	0%
		Lost some water between 18-20' 20.0-20.2'	50
		Tried to core 20.2-25.0'	60%
		25-26' 17; 30-31' 29	
		Permeability test 18-33' - Hole caved to 18' - Test is from 18-33' - casing is 3.3' above ground level. Hole took 3 gpm - set casing to 33'.	
		33-33' 25; 34-35' 28; 35-36' 25	
36.0	56.0	Granite, dark gray, feldspathic	36.5- 100
		Started coring	36.5 - 39.5' 100%
			39.5 - 41.5 100%
		Mud seams	41.5 - 46.5' 58%
		Lost water at 46'. Looks like granite boulders, weathered in place, spheroidal weathering.	
		Cased hole to 36.5'	100%
		Vertical mud seams	46.5 - 47.5'
			46.5 - 52.0' 77%
		Mud seams	49.5 - 51.0'
		Still slitting mud seams	51.0 - 59.5 64%
		Mud seams at 59.5, 61 & 65'	59.5 - 69.5' 59%

Water Pressure Tests

30.5-32.0' bottom packer set @ 30.5'

6.0 gpm @ 10 psi	
4.0 gpm @ 20 psi	
4.0 gpm @ 30 psi	
7.7 gpm @ 40 psi	
14.0 gpm @ 50 psi	
11.0 gpm @ 40 psi	
5.0 gpm @ 30 psi	
2.4 gpm @ 20 psi	

30.5-49.5' 0 gpm @ 10 psi

No water loss 0 — 50 psi

Hole bottomed at 49.5'

DH 3, STA. 11+00 C/L DAM, ELEV. 495.0
CAS 1/5-11/84

0.0	3.0	Sand, silty - brown - micaceous	(SM)
		Blow count	
3.0	25.0	Schist, brown - highly weathered	3.0-4.0' 8
			10.0-11.0 18
			13.0-14.0 23
			20.0-21.0 23
25.0	31.0	Granite, weathered - gray and white	25.0-26.0 19
			30.0-31.0 37
31.0	88.0	Phyllite, weathered, brown	35.0-36.0 3
			40.0-41.0 8
			45.0-46.0 17
			50.0-51.0 14
			51.5-52.5 17
			55.0-56.0 18
			56.5-57.5 29
			61.5-62.5 23
			65.0-66.0 23
			70.0-71.0 40
			75.0-76.0 43
			80.0-81.0 44
			85.0-86.0 47
		Cored (NX)	86.0-88.0 100% Rec.

Water Pressure Test

86.0-88.0 No leakage 0 - 50 psi

DH 4, STA. 16+75 C/L DAM, ELEV. 450.5
CAS 1/11-13/84

0.0	1.0	Topsoil & roots, sand, silty	(SM)
		Blow count 0.0-1.0' 3	
1.0	7.0	Silt, sandy to sand, silty - brown - some mica	(SM)
			1.0-2.0' 4
			2.0-3.0 8
			3.0-4.0 7
			4.0-5.0 9
		Same as above but drier	5.0-6.0 18
			6.0-7.0 14
7.0	9.0	Granite, highly weathered	7.0-8.0 23
			8.0-9.0 27
9.0	16.0	Schist, weathered	9.0-10.0 5
			10.0-11.0 4
			11.0-12.0 4
			12.0-13.0 7
			13.0-14.0 10
			14.0-15.0 10
			15.0-16.0 11
16.0	25.0	Phyllite, weathered	16.0-17.0 3
			17.0-18.0 3
			18.0-19.0 4
			19.0-20.0 5
			20.0-21.0 9
			21.0-22.0 13
			22.0-23.0 14
25.0	26.0	Granite, weathered	23.0-24.0 17
26.0	31.0	Schist, weathered	24.0-25.0 25
			25.0-26.0 35
			26.0-27.0 39
			27.0-28.0 45
			28.0-29.0 42
			29.0-30.0 48
			30.0-31.3 100
		Cored (NX)	31.3-51.0 100%

Water Pressure Test

31.5-51.0 No water loss 0 - 50 psi

Bottom of hole 51.0'

DH 5, STA. 14+00 C/L DAM, ELEV. [illegible]
CAS [illegible]

0.0	1.0	Sand, silty, brown, fine	(SM)
		Blow count	
1.0	2.0	Sand, poorly sorted, fine, dirty	1.0-2.0 8 (SP)
2.0	4.0	Sand, silty, fine	2.0-3.0 7 (SM)
			3.0-4.0 11
4.0	5.0	Sand, clayey, fine, some mica	4.0-5.0 9 (SC)
5.0	6.0	Sand, silty, fine to medium	5.0-6.0 5 (SM)
6.0	12.0	Schist, weathered	6.0-7.0 28
			7.0-8.0 24
			8.0-9.0 14
			9.0-10.0 19
			10.0-11.0 20
			11.0-12.0 27
12.0	28.5	Schist, weathered to unweathered	12.0-13.0 107
		Cored (NX)	13.0-28.5 100%
		13.0 - 28.5 Tried to pressure test hole, packers would not hold. Even though packers wouldn't hold, water pressure would become and lift rig off hole.	

Bottom of hole 28.5'

DH 201, 47.5' L STA. 8+00 C/L E. Spillway, ELEV. [illegible]
CAS [illegible]

0.0	0.5	Topsoil	(SM)
		Blow count	
			10.5-11.5 22
			15.5-16.5 46
			20.5-21.5 29
			25.5-26.5 30
			30.5-31.5 34

Bottom of hole 31.5'

DH 202, 47.5' R Sta. 8+00 C/L E. Spillway, ELEV. [illegible]
CAS [illegible]

0.0	0.5	Topsoil	(SM)
0.5	36.0	Schist, weathered	5.0-6.0 16
			10.0-11.0 25
			15.0-16.0 31
			20.0-21.0 29
			25.0-26.0 47
			30.0-31.0 71
			35.0-36.0 116

Bottom of hole 36.0'

DH 203, 47.5' R STA. 7+00 C/L E. Spillway, ELEV. [illegible]
CAS [illegible]

0.0	0.5	Topsoil, sand, silty	(SM)
0.5	21.0	Schist, weathered	5.0-6.0 15
			10.0-11.0 41
			15.0-16.0 35
			20.0-21.0 46
21.0	30.5	Schist	25.0-25.5 100
			30.0-30.5 100

Bottom of hole 30.5'

DH 204, 47.5' R STA. 8+00 C/L E. Spillway, ELEV. [illegible]
CAS [illegible]

0.0	0.5	Topsoil, sand, silty	(SM)
0.5	25.0	Schist, weathered	5.5-6.5 27
			10.0-11.0 51
			15.0-15.5 87
			20.5-21.5 46
25.0	35.0	Schist	25.0-25.5 77
			30.0-30.5 119

Bottom of hole 35.0'

DH 205, 47.5' R STA. 9+00 C/L E. Spillway, ELEV. [illegible]
CAS [illegible]

0.0	0.5	Topsoil, sand, silty	(SM)
0.5	15.0	Schist, weathered	5.0-6.0 111
			10.0-10.5 100

SHEET 10 (Continued)

"AS BUILT"

MULTIPLE PURPOSE DAM NO 1 CHERRYSTONE CREEK
CHERRYSTONE CREEK WATERSHED
PITTSYLVANIA COUNTY, VIRGINIA
LOGS OF TEST HOLES

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

VA-518-P

DH 299 (Cont'd) — Blow count

13.0 30.3 Schist — 15.0-15.2 100; 20.0-20.4 100; 25.0-25.1 100; 30.0-30.3 100

Bottom of hole 30.3'

DH 301, Sta. [illegible] C/L Dam, Elev. [illegible]

From	To	Description	Depth	Blow count	Class.
0.0	1.0	Topsoil, sand silty to GL			(SM)
1.0	6.0	Silt, sandy to clay silty, brown	1.0-2.0	6	(ML or CL)
			3.0-4.0	5	
		Gray brown	4.0-5.0	3	
			5.0-6.0	6	
6.0	11.0	Sand, silty to silt sandy, gray brown, some mica	6.0-7.0	1	(SM to ML)
			7.0-8.0	2	
			8.0-9.0	3	
			10.0-11.0	2	
11.0	14.0	Sand, poorly sorted, gray, med. to fine	11.0-12.0	11	(SP)
			12.0-13.0	27	
			13.0-14.0	6	
14.0	21.0	Schist, highly weathered	14.0-15.0	6	
			15.0-16.0	17	
			16.0-17.0	9	
			17.0-18.0	6	
			18.0-19.0	6	
			19.0-20.0	9	
			20.0-21.0	11	
21.0	39.5	Schist, weathered	21.0-22.0	13	
			22.0-23.0	11	
			23.0-24.0	16	
			24.0-25.0	16	
			25.0-26.0	18	
			26.0-27.0	11	
			27.0-28.0	23	
			28.0-29.0	29	
			29.0-30.0	19	
			31.0-32.0	28	
		Schist, weathered, but dry	32.5-33.5	46	
		" "	34.0-35.0	49	
		" "	35.5-36.5	57	
		" "	37.0-38.0	58	
		" "	38.5-39.5	63	
39.5	46.0	Schist, garnet, mica	39.5-	77	
			39.5-46.0		Core bar.

Bottom of hole 46.0'

DH 302, 150'R Sta. 14+50 C/L Dam, Elev. 643.0

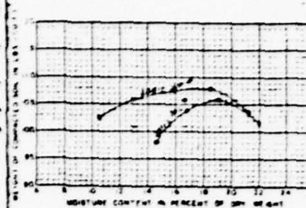
From	To	Description	Depth	Blow count	Class.
0.0	1.0	Topsoil, sand silty to GL			(SM)
1.0	2.0	Silt or clay, sandy	1.0-2.0	3	(ML or CL)
2.0	5.0	Sand, silty, brown, some mica	2.5-3.5	2	(SM)
			4.0-5.0	2	
5.0	8.0	Silt or clay, gray brown	5.5-6.5	2	(ML or CL)
			7.0-8.0	2	
8.0	13.0	Sand, silty or silt sandy	8.5-9.5	2	(SM or ML)
			10.0-11.0	2	
			11.5-12.5	2	
13.0	16.0	Sand, silty to poorly sorted gray	13.0-14.0	41	(SP to SM)
			14.5-15.5	46	
16.0	19.0	Sand to gravel, silty	16.0-17.0	17	(SM to GM)
			17.5-18.5	14	
19.0	20.5	Sand, poorly sorted, coarse to medium, clean, angular	19.0-20.0	15	(SP)
20.5	25.5	Schist, highly wea., dry	20.5-21.5	16	
			22.0-23.0	35	
			23.5-24.5	39	
			25.0-26.0	36	
			26.5-27.5	49	
26.5	30.5	Schist, wea., dry	28.0-29.0	56	
			29.5-30.5	55	

Bottom of hole 30.5'

DH 303, [illegible] Elev. [illegible]

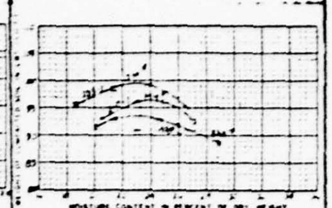
From	To	Description	Depth	Blow count	Class.
0.0	1.0	Topsoil, sand, silty to CL			(SM)
1.0	4.0	Clay or silt, brown, sandy	1.0-2.0	7	(CL or ML)
			2.5-3.5	5	
4.0	7.0	Sand, silty to poorly sorted, brown	4.0-7.0	3	(SM or SP)
			5.5-6.5	8	
7.0	8.0	Sand, silty to clayey, gray brown, some mica	7.0-8.0	7	(SM or SC)
8.0	11.0	Sand, silty to silt sandy, gray	8.5-9.5	3	(SM or ML)
			10.0-11.0	10	(SP or SM)
11.0	17.0	Sand, poorly to well sorted, medium to fine, clean, some SW	11.5-12.5	1	
			13.0-14.0	4	
			14.5-15.5	33	
17.5	19.0	Schist, highly wea.	16.0-17.0	18	
			17.5-18.5	10	
19.0	30.0	Schist, wea., dry	19.0-20.0	25	
			20.5-21.5	39	
			22.0-23.0	38	
			23.5-24.5	67	
			25.0-26.0	53	
			26.5-27.5	103	
			28.0-29.0	173	
			29.0-30.0	103	

Bottom of hole



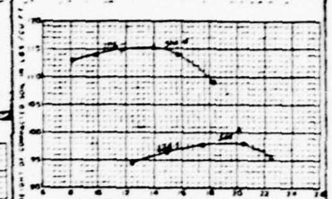
COMPACTION CURVE

LABORATORY CLASSIFICATION & FIELD NO.



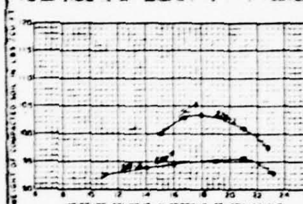
COMPACTION CURVE

LABORATORY CLASSIFICATION & FIELD NO.



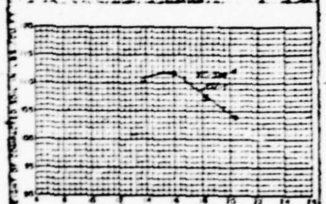
COMPACTION CURVE

LABORATORY CLASSIFICATION & FIELD NO.



COMPACTION CURVE

LABORATORY CLASSIFICATION & FIELD NO.



COMPACTION CURVE

LABORATORY CLASSIFICATION & FIELD NO.

LEGEND

TEST HOLE NUMBERING SYSTEM

Centerline of dam	1 - 99
Borrow area	101 - 199
Emergency spillway	201 - 299
Centerline of outlet structure	301 - 399
Foundation	401 - 499
Toe drain	501 - 599

UNIFIED SOIL CLASSIFICATION SYSTEM SYMBOLS

- GW Well graded gravels; gravel-sand mixtures
- GP Poorly graded gravels
- GM Silty gravels; gravel-sand-clay mixtures
- GC Clayey gravels; gravel-sand-clay mixtures
- SW Well graded sands; sand-gravel mixtures
- SP Poorly graded sands
- SM Silty sands; sand-silt mixtures
- SC Clayey sands; sand-clay mixtures
- ML Silts; silty v. fine sands; sandy or clayey silts
- CL Clays of low to medium plasticity; silty, sandy or gravelly clays
- MH Elastic silts; micaceous or diatomaceous silts
- OL Organic silts and organic silty clays of low plasticity
- OH Organic clays or silts, of medium to high plasticity

SYMBOLS

- CL Centerline
- TP Test pit dug with backhoe
- SB Streambank logged
- DH Drill hole
- DS Disturbed sample
- UD Undisturbed sample
- PP Pocket penetrometer as measured in tons/square foot
- Dd Dry density
- pcf Pounds/cubic foot
- k Constant head permeability as measured in cubic feet/square foot/day

(ML) Classification by visual inspection
ML Unified classification by lab analysis

"AS BUILT"

SHEET 11

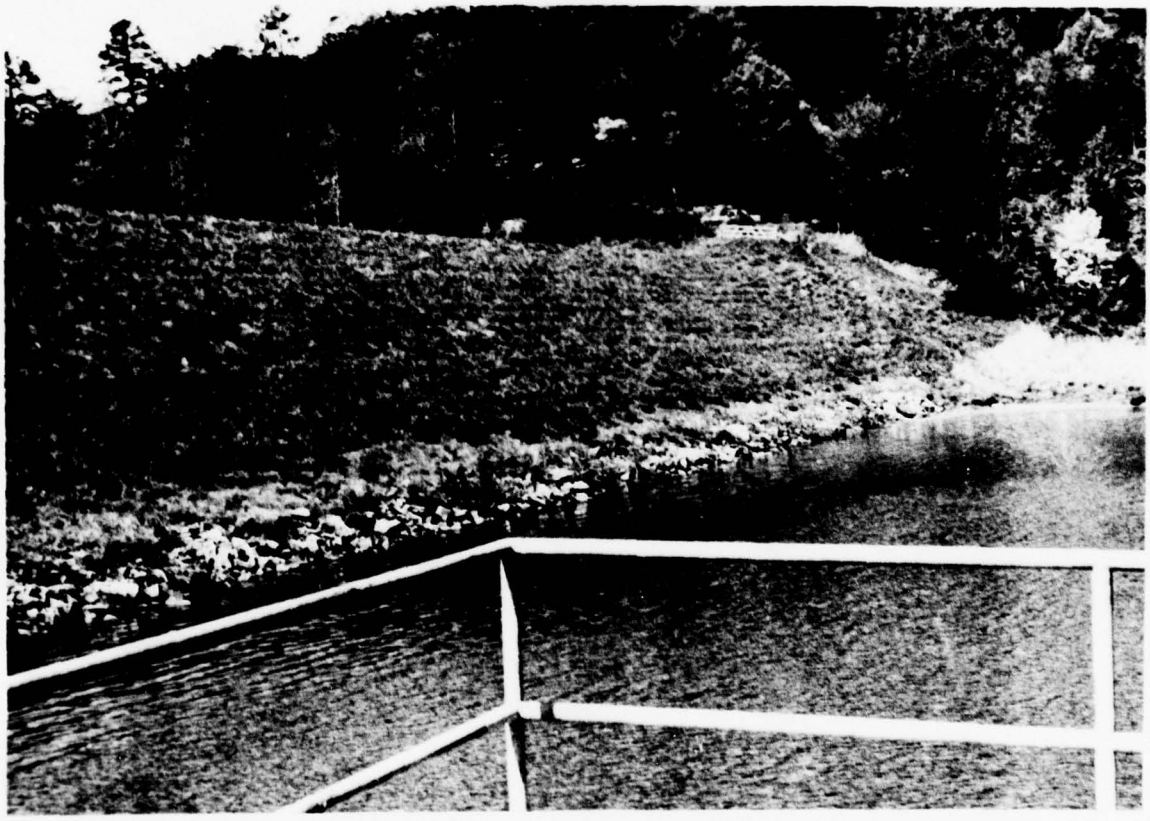
MULTIPLE PURPOSE DAM NO. 1 CHERRYSTONE CREEK
CHERRYSTONE CREEK WATERSHED
PITTSYLVANIA COUNTY, VIRGINIA
LOGS OF TEST HOLES

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

VA-518-P

APPENDIX II

PHOTOGRAPHS

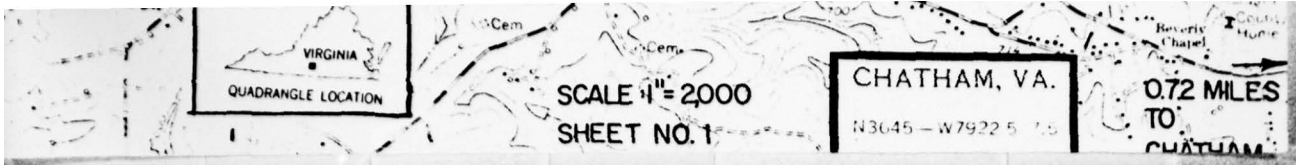


UPSTREAM FACE OF EARTHEN IMPOUNDMENT
Photo #1

INTAKE STRUCTURE AND CATWALK
Photo #2

VIEW OUTLET CHANNEL

Photo #3



OUTLET ENERGY DISSIPATOR
Note: Outlet Channel Flow

Photo #4

VIEW EMERGENCY SPILLWAY

Photo #5

WET SPOT NOTED DOWNSTREAM OF LEFT ABUTMENT
Photo #6

APPENDIX III

FIELD OBSERVATIONS

FIELD OBSERVATIONS

Name of Dam: Cherrystone No. 1

County: Pittsylvania

State: Virginia

Coordinates: Lat 36° 51.0' Long 79° 26.0'

Date of Inspection: May 1, 1979

Weather: Fair, temperature 70 °F

Pool Elevation at Time of Inspection: 663±

Tailwater at Time of Inspection: 636.5 (In stream) M.S.L.

Inspection Personnel:

Schnabel Engineering Associates, P.C.
Ray E. Martin, P.E. (recorder)
Stephen G. Werner

J. K. Timmons and Associates, Inc.
Robert G. Roop, P.E.
William A. Johns (recorder)

U.S.D.A. Soil Conservation Service
Russel Vaughan, Jr.

Town of Chatham, Virginia
Bert Williamson

State Water Control Board
Hugh Gildea, P.E.

Pittsylvania SWCD
Robert Stump

1 Embankment:

1.1 Surface Cracks: The slopes, crest, emergency spillway, and abutment contacts were inspected and no cracks were noted. The toe of the downstream slope of the dam was covered with light vegetation, 3 to 4 ft high,

making observations difficult. Occasional (1 to 3" diameter) trees were also growing in this same general area.

1.2 Unusual Movement: No unusual movements were noted on the dam or downstream beyond the embankment toe.

1.3 Sloughing or Erosion: No sloughing or erosion was noted.

1.4 Alignment: The vertical and horizontal alignment of the dam was visually observed to be in accordance with "as built" drawings.

1.5 Riprap: Generally showed no displacement or washing and appeared to be in proper alignment. Minor erosion of riprap was noted along both sides of the outlet structure.

1.6 Junctions: Conditions appear good at the junction of the embankment and the abutments. The junctions are vegetated with grass and no bedrock outcrops were observed. A steep gulley enters the impoundment/right abutment area from the road.

1.7 Seepage: The toe or basal 15 ft± downstream embankment slope was moist; however, no seepage was observed. There appears to be considerable ponded water just below the downstream toe of the embankment to the right of the principal spillway outlet. This area is fed by water from a spring located below the right abutment embankment interface. Cattails fan and marsh grass are present. This type of vegetation is indicative of long term poorly drained areas. The left

downstream embankment abutment interface contains a zone of thick, dark green grass indicating the presence of a spring or seepage. The same type grass is present at the downstream end of the emergency spillway. None of these are believed to be fed by seepage through the dam.

1.8 Staff Gage: None found.

1.9 Drains: The design report and "as built" drawings show the presence of a rock toe drain consisting of a two-element filter and 10 inch perforated drain pipe with outlet onto the concrete impact basin. Rock toe drain outlet pipes were not observed during the inspection due to the high level of the tailwater.

2 Reservoir:

2.1 Slopes: The upstream end of the reservoir is occupied in part by the creek floodplain. Generally, gentle to moderate slopes with thick vegetation and woods bound the impoundment. The right abutment has gentle to moderate slopes, while the steeper left abutment has moderate to steep slopes. No sloughing was observed at the time of the inspection and the area was essentially free of debris.

2.2 Sedimentation: None observed.

3 Downstream Channel:

3.1 Condition: Minor debris was present. The channel is about 15 ft wide, 4 ft deep and bound by a 300 ft$^{+}_{-}$ wooded floodplain.

3.2 Slopes: Downstream, moderate to steep, wooded natural slopes occur along the left and right sides of the stream. The stream valley is rather broad immediately

below the dam but narrows considerably approximately one mile below the dam. Slopes of 1:1 were estimated on the channel and 2:1 at the floodplain edge. No slope failures were noted in the valley adjacent to the toe of the dam.

3.3 Population and Facilities: None immediately downstream, but homes and industry exist in Chatham, about 2.5 miles downstream.

4 Principal Spillway:

4.1 Intake Structure: The structure was in good condition. No top on the manhole. Small amount of debris in inlets. Gates were operable in 1972.

4.2 Outlet Structure: 42". In good condition. Half-full. The energy dissipator was in excellent condition.

5 Emergency Spillway:

5.1 Channel Section: Well vegetated; 150 ft wide.

6 Instrumentation:

6.1 Monumentation: None.

6.2 Observation Wells and Piezometers: No observation wells or piezometers were noted in the field.

APPENDIX IV

STABILITY ANALYSIS

SUMMARY

(11.58)

SUMMARY OF SHEAR TEST DA

State VIRGINIA Watershed or Subwatershed Cherrystone W/S

Site No.	Laboratory Sample Number	Indicator Test Data: Mechanical Analysis % smaller than: 0.002 mm	0.005 mm	#200 sieve	% Disp.	% Sol. Salts	Atterberg Limits: L.L.	P.I.	Class	Moisture-Density: Std. or Mod.	Max γ_d	Opt. w in %	Cores: Dry Unit Weight	w in %	Shear Data: Test γ_d	Moist ϕ	Moist c	Moist w in %	Saturated ϕ	Saturated c	Saturated w in %
1	66W3088	10	16	39	—	—	24	0	SM				1.26	35.1	94.0				35°	375	
		11	18	49			26	3	SM				143	91.5							
	66W3090	29	35	53	-	-	45	14	ML	95% Std.	106.0	19.0							17.5°	950	
	66W3091	5	8	30			Non Plastic		SM	95.1% Std.	95.5	21.0			98.6				32.5°	650	
																	1				
															6-21-66						
24	67W2322	5	6	17			Non Plastic		SM				1.34	13.2	95.6				34.5°	320	
	67W2327	3	6	32			Non Plastic		SM				1.34	36.9	94.5				32.5°	275	
	67W2324	52	59	79			53	13	MH	95% Std.	99.0	29.5			91.9				16°	1275	
	67W2326	6	12	45			41	0	SM	95% Std.	97.0	21.0			90.1				26.5°	622	

(Pittsylvania Co)

Conditions Used for Stability Analysis	Height of Dam	Slope Data			
		Upstream		Downstream	
		Z_u	F_s	Z_d	F_s
MAXIMUM SECTION					
1 Rapid - No berm - Arc cut from upp shld'r thru Emb (175°-950) only.	53.4	2½:1	1.77		
1 " " " " " " " " " (275°-650) " .	53.4'	2½:1	1.61		
FLOOD PLAIN SECTION					
1 Rapid 10' berm - Arc cut from upp shld'r thru Emb (275°-650) & 16.0' Found (35°-375).	51.4'	2½:1 & 3:1	1.69		
2 Rapids 30.6 - No berm - Arc cut from upp shldr thru Emb (275°-650) & 14' Found (35°-375)	51.4			2½:1	3.1
(Class E) (4-6-67) Ht = 67					

NOTE: The entire stability analysis could not be located by the Soil Conservation Service.

APPENDIX V

DESIGN REPORT

CHERRYSTONE CREEK

WATERSHED PROTECTION PROJECT

DESIGN REPORT

SITE NO. 1

PITTSYLVANIA COUNTY

VIRGINIA

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

INDEX

OCTOBER 1965

STATE OFFICE
Richmond, Virginia

This multiple-purpose dam is located approximately 2½ miles northwest of Chatham, Virginia, on Cherrystone Creek. Sheet 5 of this report, together with the Chatham, Virginia, 15-minute quadrangle published by the U. S. Geological Survey, may be used to locate this structure.

This is one of three proposed floodwater retarding structures in the Cherrystone Watershed. The purposes of the dam are to reduce downstream flooding by providing temporary storage for the runoff from 14.7 square miles and to provide permanent storage for 850 acre-feet of water supply. The temporary storage is released gradually through a two-stage principal spillway system.

The results of hydrologic and hydraulic computations are given on sheet 4 of this report.

The structure consists of a compacted earth fill with a cutoff extending through silts, sands, and weathered schist. A drainage system is located under the downstream portion of the earth fill to control the phreatic surface and to collect seepage.

The principal spillway is a drop inlet structure consisting of a two-stage reinforced concrete riser, 42-inch diameter reinforced concrete water pipe, and a reinforced concrete impact basin to dissipate the energy of high velocity discharge at the outlet end of the conduit.

The emergency spillway is designed as an earth cut in the left abutment.

Copies of reports covering geologic conditions and soil engineering tests are included in the design folder.

DEPARTMENT OF AGRICULTURE — SOIL CONSERVATION SERVICE

EARTH DAM # 1 DETAIL

I. Tabulated data

A. Structure class	B	
B. Drainage area	9.10	Sq. Mi.
C. Time of concentration - T_c	37	Hrs.
D. Hydrologic curve number - C_n		
1. Moisture condition II	65	
2. Moisture condition III	83	

II. Principal spillway

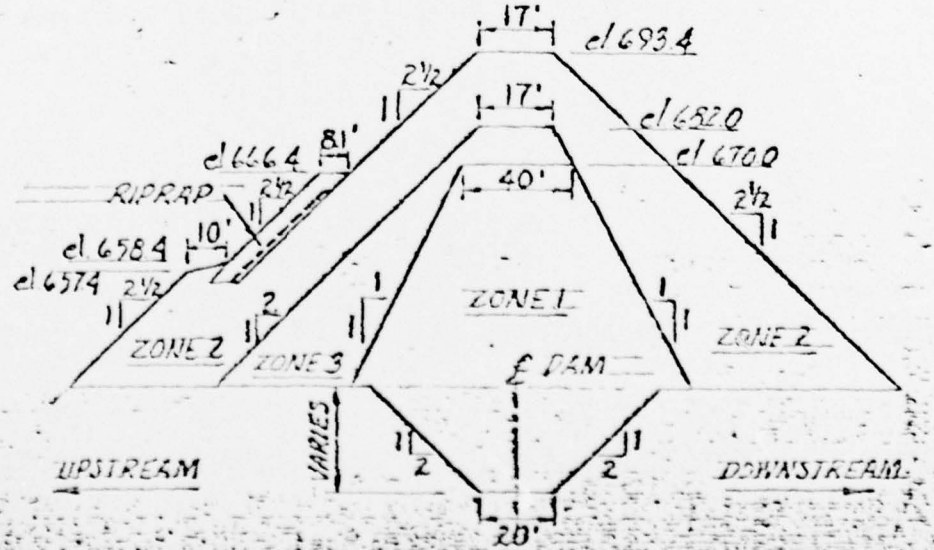
A. Conduit		
1. Size (I.D.)	42	In.
2. Length	280	Ft.
B. Riser		
1. Size	3.5x10.5	Ft.
2. Height	33.0	Ft.
C. Weir length	21.0	Ft.
D. Orifice size	14x27	In.
E. Pond drain size	36	In.
F. Type of energy dissipator	concrete impact basin	

III. Emergency spillway

A. Width	135	Ft.
B. Side slopes	3:1	
C. Length of level section	30	Ft.
D. Exit slope	6.22.5	Ft./Ft.
E. Maximum velocity at control section (D.E.W.)	7.4	Ft./sec.
F. Duration of flow (D.E.W.) through emergency spillway	19.2	Hrs.
G. Frequency of use	less than once in 100 years	

IV. Earth fill

A. Height	55.4	Ft.
B. Volume	183.733	C.Y.
C. Compaction	class A, 95% S.P.	



FILL PLACEMENT

ENGINEERING & WATERSHED PLANNING UNIT, UPPER DARBY, PA.

U. S. DEPARTMENT OF AGRICULTURE - SOIL CONSERVATION SERVICE

Element of Structure	Determining Factor	Elevation	Surface Area Acres	Storage		Inflow		Basic Outflow c.f.s.
				Acre-Feet	Inches*	Volume Inches*	Rate c.f.s.	
Invert of orifice	100 year sediment accumulation + 850 ac. ft. of water supply	662.4	105	10.92 [1]	1.39	-	-	0
Crest of riser	set to store 15" [3]	671.5	120	1176 [2]	1.50	-	-	177
Crest of emergency spillway	100 year frequency storm, moisture condition II	682.1	256	3372 [2]	4.30	-	-	264
Design high water	130 X value from EC-1020 Sh. 3 ** moisture condition II	685.6	282	4270 [2]	5.45	6.19	13,122	2,310
Top of dam	140 X value from EC-1020 Sh. 4 ** moisture condition	693.4	342	6710 [2]	8.56	14.81	28,644	14,470

*Volume expressed in inches of runoff from controlled watershed area of 2410 acres.
**Refer to hydrologic criteria in National Engineering Memorandum SCS-27
Time required to empty flood storage is 1451 days

[1] Does not include 158 acre-feet of sediment allocated to flood pool.
[2] Does not include 1250 acre-feet of sediment & beneficial storage.
[3] Established in the planning phase to provide desired protection.

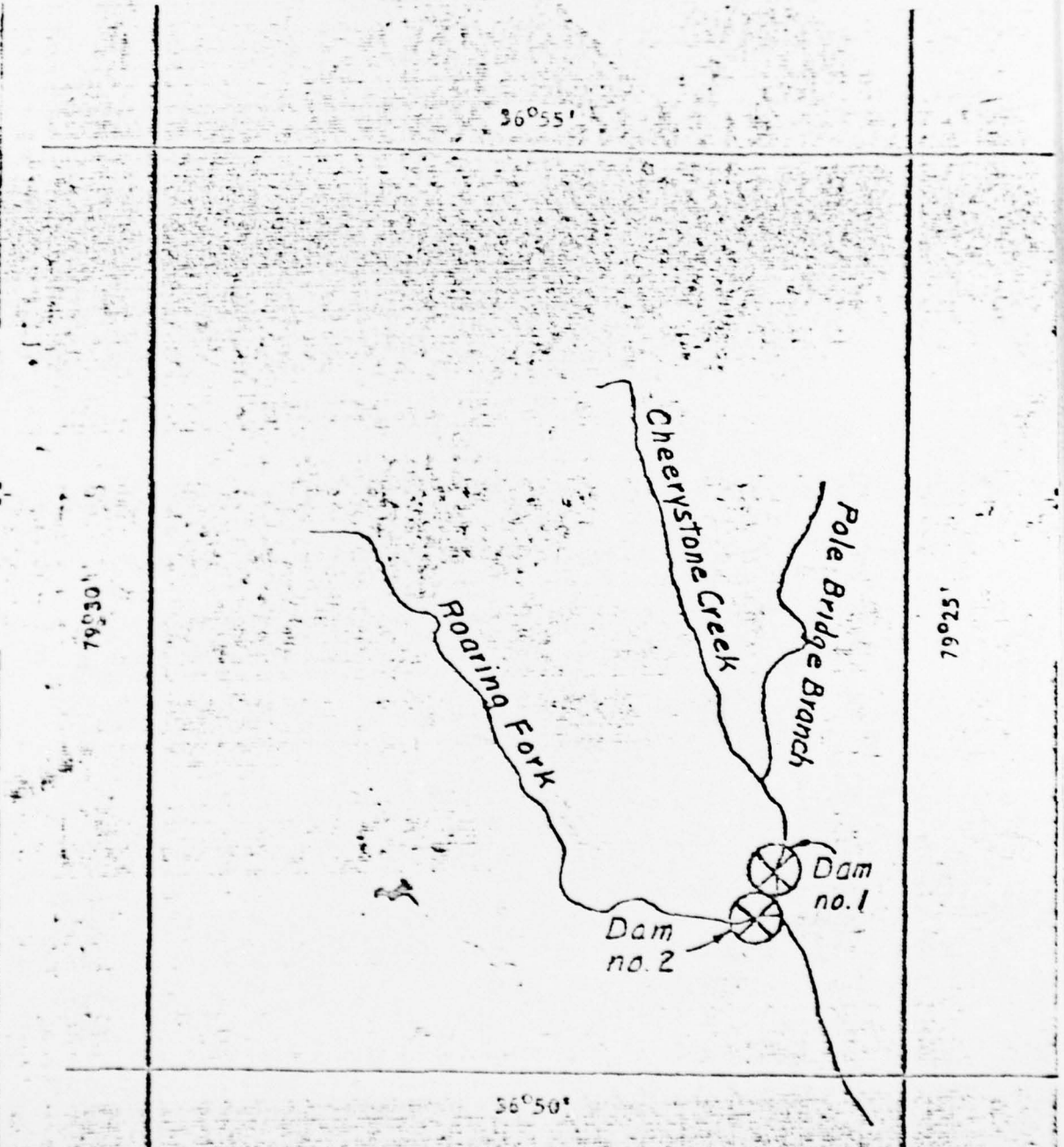
State Office, Richmond, Virginia

CHEERYSTONE CREEK

WATERSHED PROTECTION PROJECT

DUK NO.1 - -

PITTSYLVANIA COUNTY, VIRGINIA



Reference:
CHATHAM, VA.
15' Quadrangle. STATE OFFICE, Richmond, Virginia

Sheet 5 of

A summary of pertinent design information is given on Sheet 3 of this report.

Criteria and procedures used in this design are given in the following Soil Conservation Service publications:

National Engineering Memorandum No. 27, Limiting Criteria for the Design of Earth Dams
National Engineering Memorandum No. 50, Drop Inlet Spillway Standards
National Engineering Handbook No. 4A, Hydrology
National Engineering Handbook No. 5, Hydraulics
National Engineering Handbook No. 6, Structural Design
National Engineering Handbook No. 8, Geology
Engineering Division Technical Release No. 2, Earth Spillways
Engineering Division Technical Release No. 5, Structural Design of Underground Conduits
Engineering Division Technical Release No. 10, Storage - Floodwater Retarding Structures
Engineering Division Technical Release No. 12, Procedure for Computing Sediment Requirements for Retarding Structures
Engineering Division Technical Release No. 18, Joint Gap Computation for Reinforced Concrete Pipe Drop Inlet Barrels
Engineering Division Technical Release No. 26, The Use of Soils Containing More Than 5 Percent Rock larger Than The No. 4 Sieve
Engineering Division Technical Release No. 27, Laboratory and Field Test Procedure for Control of Density and Moisture of Compacted Earth Embankments, with Appendix: Details on Construction Control Tests for Rocky Soils in Compacted Earth Embankments.
Engineering Division Technical Release No. 30, Structural Design of Standard Covered Risers
Weather Bureau Technical Paper No. 40. §49.

Copies of the publications referred to in this report may be obtained from Mr. Tom F. McGourin, State Conservationist, USDA-Soil Conservation Service, Richmond, Virginia.

R. C. Barnes, Jr.
State Conservation Engineer

BY RHS DATE 9.65 CHECKED BY DATE JOB NO VA-512-E

SUBJECT Embankment and Foundation Summary SHEET 1 OF 22

The soils report states that the stability of the slopes was checked for full rapid drawdown and 2 1/2:1 upstream slope with no berm and the safety factor resulting was satisfactory. Since we are using a total of 18' for berms there is no need to use a 3:1 slope below the pool. Although it is usual to recheck the stability based on final embankment proportioning the safety factors resulting from homogeneous sections were large enough to make this unnecessary.

The dam will be zoned as recommended by the lab, but it may be found during construction that zone 1 material is at a premium. There should be sufficient cohesive material to build the template section to normal pool, then zone 3 material could be used in the core. It is felt that the highly weathered schist in the emergency spillway will break down to a GM or SM when excavated and compacted. All material will be placed as class A at 95% of standard proctor and moisture contents as recommended by the soils lab.

Piping between zones at the interfaces should not present a problem based on criteria from Navdocks DM-7, page 7-8-13. Cracking should not be critical in the structure due to the flat excavation slopes.

The cutoff trench bottom width was checked by the method suggested in the Bureau of Reclamation "Design of Small Dams" and 20' was found to be sufficient throughout. The side slopes of the trench will be 2:1 with a transition and 3:1 slopes through the intersection with the conduit trench. The depth of the trench will be well into the weathered schist foundation. There is some seepage expected to occur below the cutoff, but based on a highly conservative permeability estimate the flow will not be critical with respect to stability of the base, loss of beneficial storage, or capacity of the drainage system.

The required joint extensibility was computed by the TR-18 approach. The maximum average unit vertical strain was computed and found to agree favorably with the lab's results. Based on this, it is found that deep joints are required.

The limits of riprap for wave protection were set based on base flow and wave freeboard for the top elevation and a 6-month drought and evaporation for the lower elevation. A berm is used at the lower elevation to help prevent unraveling of the rock.

The drain trench consists of a two-element filter to be stable against fine-grained material and a 10" perforated drain pipe. The trench outlets into a concrete impact basin. The filter limits as suggested by the lab should be met by Virginia Highway and AASHO standard aggregates.

APPENDIX VI

GEOLOGIC REPORT

Virginia Pittsylvania Cherrystone

I C

Geologist 11/65 & 1

SITE DATA

Flood Prevention &

14.7 Earth Fill Water Supply

South 50.7 800

153,000

STORAGE ALLOCATION

	400	52	
	3372	256	
Water Supply	850	105	

SURFACE GEOLOGY AND PHYSIOGRAPHY

Piedmont Province Rolling 250 feet

Left 25-35 percent Right 15-25 percent

General geology of site Cherrystone Site #1 is underlain by schist and phyllite with minor intrusions of granite. The main minerals present are mica, garnet, feldspar, quartz and minor amounts of accessory minerals. The bedrock is weathered to depths ranging from a few feet to 90 feet in the right abutment. The rocks are part of the metamorphosed sediments of uncertain age previously mapped as Wissahickon schist pre-Cambrian or Early Cambrian age. Some dikes and intrusions are present which are obviously of later age. There is a dike present in the right abutment which doesn't show the degree of weathering that the surrounding country rock shows.

Cherrystone Creek flows in a strongly entrenched dendritic pattern. The hillsides are gentle to moderately steep and the valleys are flat. The topography has reached maturity.

Centerline, Principal Spillway, Emergency Spillway & Borrow Area

(Centerline of Dam, Principal Spillway, Emergency Spillway, the Stream Channel, Investigations for Drainage of Structure, Borrow Area, Reference Bush, etc.)

DRILLING PROGRAM

Equipment Used	Number of Holes: Exploration	Number of Holes: Sampling	Number of Samples Taken: Undisturbed (state type)	Disturbed: Large	Disturbed: Small
Tractor Mounted Backhoe			1 (4' Shelby Tube)		
S & H Core Drill			1 (5" Shelby Tube)		
Total					

SUMMARY OF FINDINGS
(include only factual data)

Centerline of the Dam

The centerline of the dam is characterized by fairly shallow soils above a layer of weathered bedrock. The right abutment is gentle to moderate with a slope of 15-25% with no rock outcrop. At and near the base of the slope there is an abundance of residual boulders: evidently these residual boulders are the remains of a dike of granite that has weathered in place. The left abutment has moderate to steep slopes ranging from 25-40%. The flood plain is covered with a deep alluvial soil composed of silty sand and sandy silt, very fine to fine with mica. Depths of this material range from a few feet to fifteen feet in places. In-place density samples were taken and values of 103 and 120.2 wet weight and 71.9 and 85.1 dry weight per cubic foot were obtained; the moisture content was 43.2 and 41.3 percent, respectively. The layer below the SM and ML on the flood plain is composed of ML to CL with minor amounts of fine to coarse SP and SW. These layers of SP and SW are haphazardly located and are not continuous enough to be correlated. Both abutments were dry, but some water loss was recorded in two of the drill holes (See DH 1 & 2). Three channels are located on the flood plain; the main channel is located approximately in the center of the flood plain. A large auxiliary channel is located to the right of the main channel and a small tributary channel is located to the left of

the main channel. The right side of the flood plain is slightly swamped out, which may present some drainage problems during construction.

Spillways

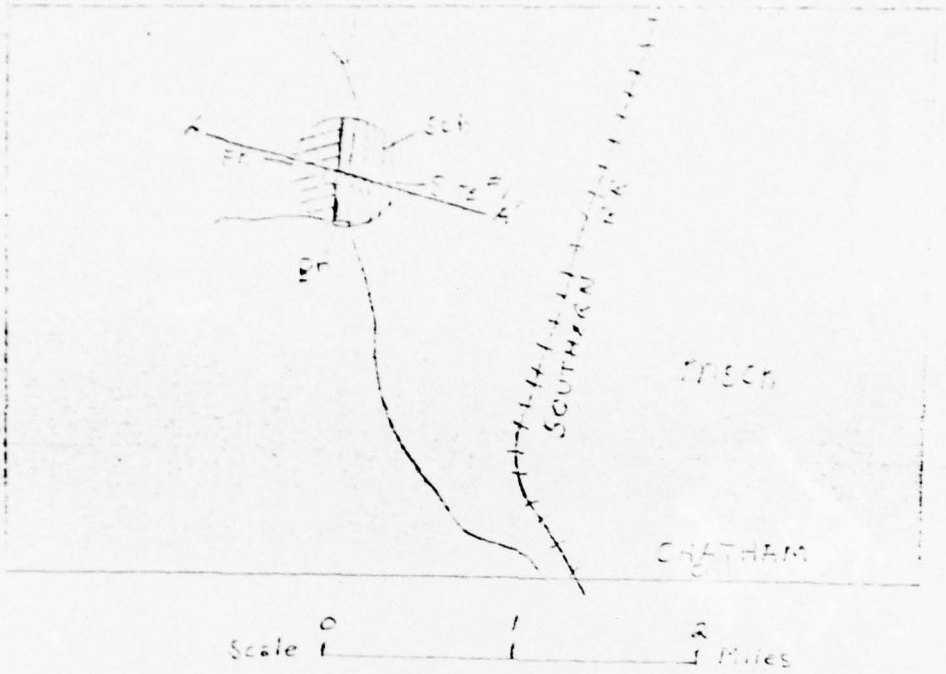
Two principal spillway locations were investigated. The one chosen as the better location, designated Pipe Line A, is at 16+50 on the centerline of the dam. The alternate, Pipeline B, is located at 15+00 on the centerline. Most of the test pits did not end in bedrock but by probing a bedrock profile was determined. This bedrock profile was modified after the core drilling. The probing depths on Pipeline A ranged from 11 to 13'. This depth had to be lowered to 17-25' from the blow counts recorded during drilling. The depth of the cutoff will be determined from the material found during construction. The material is alluvial sand, silt and clay with minor amounts of fine gravel. Pipeline B had an uneven rock surface. The upstream depth was below 15 feet and the downstream depth was below 13 feet, but firm bedrock was found at 8 feet on the centerline.

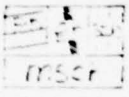
The emergency spillway is to be located in a saddle in the left abutment. The material found in the test pits consisted of a fine to very fine silty sand (SM) and sandy silt (ML) with minor amounts of SC and CL. This material is the weathered product of garnet mica schist, with minor intrusions of granite and graphic granite. The drill holes encountered weathered to unweathered garnet mica schist. No rock was found which will not be able to be removed by ordinary excavating methods.

Borrow Area

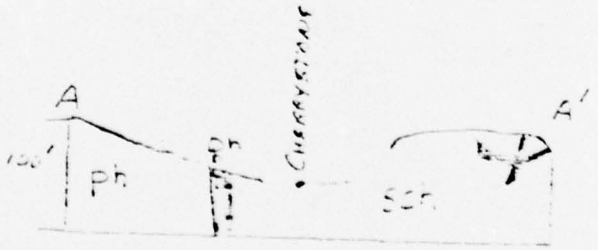
The main source of borrow will be the emergency spillway cut. Of the 153,000 cubic yards needed, about 90 percent will be excavated from the emergency spillway. This material will consist of SM and ML, with minor amounts of CL and SC. The weathered to unweathered garnet mica schist will break down to form a micaceous SM to GM.

Two additional borrow areas were investigated, one in the right abutment area and the other in the abutments of the small tributary above the emergency spillway area. The borrow area in the right abutment is located in an area of colluvial and residual silty and clayey sand - See samples 103-1 & 106-1. The borrow in the left abutment is mostly residual sandy silt and silty sand. There is sufficient borrow between the spillway and these two borrow areas to build the dam. The top 6 feet in the emergency spillway, plus borrow obtained from the abutment area, can be used for core material and the remainder used elsewhere in the dam.





METAMORPHOSED SEDIMENTS OF PF UNCERTAIN AGE,
MSCH—MUSCOVITE-CHLORITE-QUARTZ-ALBITE SCHIST & GNEISS
PH-PHYLLITE, QT—PEGMATITIC GRANITE, SCH—GARNET MICA SCHIST



GEOLOGIC MAP OF THE AREA AROUND SITE #1 CHERRYSTONE WATERSHED, PITTSYLVANIA COUNTY, VIRGINIA.

SHEET 4 OF 5 VA 5716-C

SOIL SAMPLE LIST
SOIL AND FOUNDATION INVESTIGATIONS

Location Pittsylvania Co., Va. Owner

Watershed Cherrystone Sub-watershed Site No. 1

Submitted by R. C. Barnes, State Conservation Engineer Date 4 19 66

Sent by Truck (carrier) Government S/L No.

Lab. No.	Field Sample No.	Sample Description		Depth		Type of Sample	
		Location	Grid or Station	From	To	Undist.	Dist.
	1-1	Centerline	16+25	1.5'	4	x	
	1-2	"	16+25	4'	6.5	x	
		LARGE					
	103-1	Borrow Area	Right Abutment	1	8.5		x
	106-1	" "	" "	1	6		x
	107-1	" "	Left Abutment	1	5		x
	108-1	" "	" "	1	11'		x
	201-1	E. Spillway	Control sec	1	5'		x
	201-2	" "	" "	5	12+		x
	204-1	" "		1	5+		x
	210-1	" "		1	12+		x
	213-1	" "		1	7+		x
	224-1	" "		1	12+		x
		SMALL					
	304-1	P. Spillway	16+50 on C/L	1	4		x
	304-2	" "	"	4	8		x
	304-3	" "	"	8	12.5		x
	305-1	" "	60' Downstream	6	10		x
	307-1	" "	150' Downstream	10	12		x
	501-1	Toe Drain	100' Downstream from 1+50	1	4		x
	501-2	" "		4	9		x
	501-3	" "		9	12.5		x
	503-1	" "	100' Downstream from 8+70	1	5		x

Original to Soils Laboratory
Copy to E and WP Unit
Distribute other copies as directed by State Conservationist

Sheet 5 of 5 Sheets

Virginia ___ Penn. Pittsylvania ___ Watershed Cherrystone ___ Submitted ___ 12/[illegible]

Site number 1 ___ Div. group I ___ Structure class C ___ Investigated by L. A. Gorman, Geologist ___ Date 1/[illegible]

INTERPRETATIONS AND CONCLUSIONS

FOR IN-SERVICE USE ONLY

1. Foundation conditions appear adequate. Both abutments are covered with a thin soil mantle over weathered bedrock.

2. The principal spillway is to be located on the left side of the main channel. Penetration tests of the weathered schist showed that about 20 feet of the alluvial and weathered material will have to be removed. Some settlement of the foundation will occur during and after putting in the compacted backfill.

3. The flood plain material is very slowly permeable, but some lenses of fine to medium sand are present. These lenses are quite permeable, so an impermeable core is needed. The bedrock is deeply weathered, so a core trench at least 20' deep will be necessary. Actual depths will have to be determined during construction. It may be necessary to cut the core up to the top of the dam because of the weathered rock present.

4. The borrow material to be used as the core is quite impermeable, but the outer shell material will be slowly permeable, so foundation drainage is necessary.

5. No rock excavation will be necessary in the emergency spillway cut according to drill hole information. Extensive ripping will be needed.

6. The abutments and spillway areas are dry and well drained, so no drainage appears needed in these areas.

7. Sufficient borrow is available at the site. The top 5 - 6 feet in the emergency spillway cut, plus the borrow from the two additional borrow areas, will be enough for the core. The deeper material will be best for the outer shell.

8. A dike of feldspathic granite is present in the lower right abutment. Special care will have to be taken when cutting the core through this zone. Large residual boulders are present in clayey material. These boulders may give the impression of bedrock, so some care will have to be taken to insure a positive cutoff.

9. This structure is to be a Class C multipurpose structure, so leakage and seepage will have to be held to a minimum. No geologic conditions exist which will prevent a safe structure to be built.

APPENDIX VII - REFERENCES

1. Recommended Guidelines for Safety Inspection of Dams, Department of Army, Office of the Chief of Engineers, 46 pp.

2. Geology and Ground-water Resources of Pittsylvania and Halifax Counties, Bulletin 75, Harry E. LeGrand, Virginia Division of Mineral Resources, 1960, 85 pp.

3. Section 4, Hydrology, Part 1, Watershed Planning, SCS National Engineering Handbook, Soil Conservation Service, U. S. Department of Agriculture, 1964.

4. Hydrometerological Report No. 33, U. S. Department of Commerce, Weather Bureau, U. S. Department of Army, Corps of Engineers, Washington, D.C., April 1956.

5. Design Manual, Soil Mechanics, Foundations, and Earth Structures, Navdocks DM-7, Department of the Navy, Bureau of Yards and Docks, Washington, D.C., March 1974.